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The Vacuum System of Steam Heating.

The use of steam for heating purposes would seem to the uninitiated to be an extremely simple affair. A sufficient volume and pressure of steam being provided, and pipes through which to circulate it and from which to radiate the heat, with an opening at the end of the system for the escape of water, air and surplus steam, it would then be merely necessary to turn on the steam and let it drive through, and when things got too hot to shut it off, and repeat the operation continuously. With this crude arrangement there would be no stable or satisfactory temperature, and there would be trouble with the steam, the air and the water, with hammering and noises thrown in, but all these things were at first considered as inseparable accompaniments of the use of steam for heating. When exhaust steam from engines was used for heating there was the additional objection of the back pressure which was thrown on the engine and the consequent loss of power.

Much thought and ingenuity have been expended in the development of the modern systems of steam heating, and perhaps in no field more successfully. The steam heating arrangements at present installed and being installed leave little to be desired or suggested.

The primary requirements for an effective steam heating system have been summarized as follows: Absence of back pressure where exhaust steam is used, efficient preliminary drainage of supply pipe, automatic drainage of condensation, effective circulation, control of circulation at will, removal of air and gases from heating surfaces and from return feed water, regulation of temperature in any part of heating surface, return of water from below the line of drip or drainage if necessary.

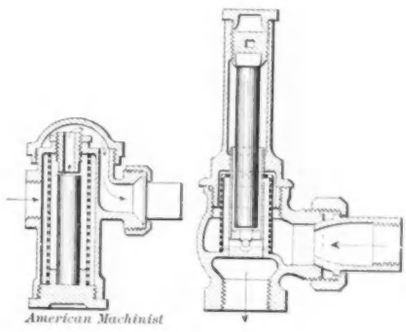

Fig. 1

This enumeration of requirements is also an enumeration of what is claimed is accomplished by the "vacuum" system of steam heating. The name comes from the employment of a suction apparatus, such as a pump or ejector, and a connection of the same by an automatic outlet valve with each part requiring drainage, abstracting all air and gases from the heating system. The complete system returns the condensed water into a heater, wherein the water and gases separate, and where the temperature of this water, with such addition as may be required to maintain the supply, is raised by direct contact with exhaust or waste steam and returned automatically to the boiler. The apparatus is under automatic regulation throughout, while the control of each individual coil or radiator is in the hands of the tenant or occupant by the manipulation of a single valve. The temperature of any coil or radiator may be reduced or controlled without water logging or hammering, and entirely independently of any other part of the apparatus.

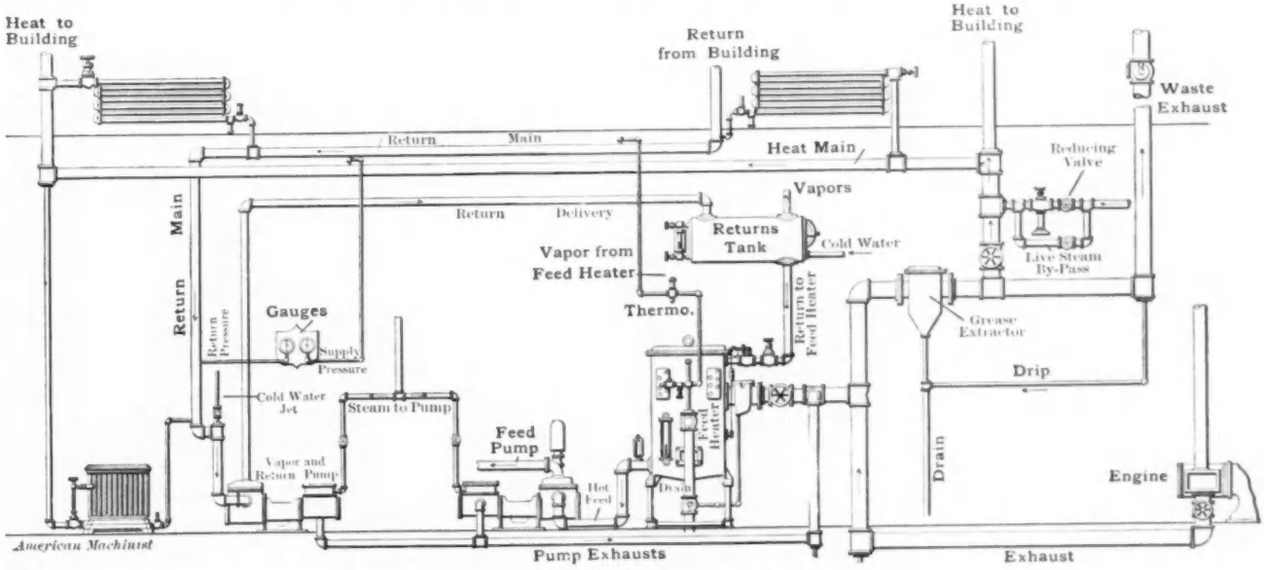

Fig. 2. VACUUM SYSTEM OF STEAM HEATING.

A thermostatic valve, two forms of which are shown at Fig. 1, is placed at the point of drainage of each coil or radiator,

one branch connecting with the return main, in which, as is understood, a partial vacuum is constantly maintained. The long central plug in this valve is of hard rubber, which expands when heated and contracts upon cooling by a much greater amount than the shell. The valve is adjusted to be closed when at the temperature of steam at say atmospheric pressure, and to open by the contraction of the plug as the temperature falls. The consequence is that when water is condensed in any appreciable quantity no steam gets to the valve, the plug contracts, the valve opens and the water and air escape. If steam is shut off from the radiator, either automatically or by hand, the valve of course opens and remains open, and, the water of condensation being all drawn off, the radiator is always empty when steam is again turned on.

The "Vacuum" system is a complete system and not the mere application of a single device. Another important feature of it, besides that mentioned above, is the feed water heater. This is a closed vertical rectangular chamber with an upper inlet for the feed water, which is the condensed water from the coils, with what fresh cold water may be added to maintain the supply. There is also an inlet for steam which passes a grease extractor before entering. The entire interior is filled with the steam; the feed water spreads successively over and percolates in a finely divided condition several perforated and oppositely inclined copper trays. The air or gases that may have escaped thus far are here gotten rid of. The water becomes thoroughly heated, and as it accumulates in the bottom of a heater a desirable opportunity occurs for the settlement of solids, which are drawn off by the inclined bottom and drain pipe below. Floating scum or light impurities are also taken care of.

A general comprehension of the entire system may be gathered from Fig. 2, which we take from a paper by R. P. Bolton, C. E., read before the American Society of Heating and Ventilating Engineers. The arrangement is modified in various ways to suit different conditions. Practically everything is automatically attended to, the automatic devices being easily adjustable for different temperatures, etc., as may be required. Live steam at low pressure, down to or below that of the atmosphere may be employed precisely as the exhaust steam is used. Absolutely no pressure is required behind the steam to drive it along and the water and air are always removed in advance of it or as soon as they accumulate.

The uncertainties, irregularities and perplexities of steam heating are by this system largely disposed of, and its adoption insures a certainty of circulation, of drainage, of absence of noise, and of efficient return of heat to the boiler not dreamed of in the olden time. Warren Webster & Co., Camden, N. J., are introducing this system.

Some Points in Cycle Construction.*

BY F. J. OSMOND.

The best machine both for racing and for ordinary riding is that which is most efficient. The principal causes of inefficiency in a cycle are want of rigidity and friction. Of these two sources of inefficiency, it is probable that want of rigidity is the more important. The work done in springing the frame out of shape at each stroke of the foot is not spent in driving at the end of the downstroke, but only in lifting the foot at the beginning of the upstroke. The amount of exertion wasted in this way may be fairly estimated by sitting on a machine with the wheels fixed, and alternately applying and relieving the pressure of the foot on the pedal; the more springy the machine, the greater will be the fatigue experienced. The springing of the frame causes a general condition of instability, due partly to the alteration of the balance through the lateral movements of the pedals, and partly to the wheels being forced out of line, thereby causing the machine to swerve from side to side, instead of running a true course.

Friction.—In a machine with well-constructed bearings, friction is mainly due to the chain. The consequent loss has been variously estimated; as low as 1 per cent. of the total power has been recently given. If this were correct, chain driving would be the most efficient means of transmitting power at present known. Probably, however, the loss was measured when the chain was not doing any work, which would make the test fallacious. About 5 per cent. seems nearer the truth.

Factor of Safety.—It has been said that the factor of safety for a cycle frame is about 1¼. If this is understood to mean that a machine designed for a 150-pound rider should not be ridden by one exceeding 210 pounds, it is probably not far out in most cases; yet a well-built frame will carry a steady load of at least ten times its weight without injury. The difference between these two statements is due to the fact that the front part of the frame is exposed to shocks which must cause bending stresses near the head; for if the two front tubes are arranged so that their axes intersect vertically above the axle of the front wheel, the stresses are only pure tension and compression, so long as the force acting through the front axle is purely vertical. It is evident that this is not the case when the front wheel meets a brick or other obstacle which represents a force acting obliquely; whilst when the wheel drops on the other side of the obstacle, there is a shock which is vertical. It is thus impossible to avoid bending; and the best compromise is obtained by making the axes of the two tubes meet some distance behind the perpendicular through the front axle. This consideration is sufficient to justify the present shape of frame with short head and horizontal top-tube. Any considerable obstacle surmounted by the front wheel causes two distinct shocks, the first oblique and the second vertical; and these shocks will in general tend to bend the front tubes first in one direction and then in the other. The bending moments are greatest close to the head, just where the tubes have been weakened by brazing; it is therefore necessary to provide some local strengthening. This the author gives by shrinking a reinforcement about 4 inches long upon the outside of the tube ends; the tubes are brazed together at the ends, tapered in a lathe, and the whole then brazed into the lug. By this means the part weakened by the brazing is kept within the reinforcement, and breakage is practically impossible.

Large Tubes.—Although there is an evident advantage in increasing the diameter of tubes subjected to bending and tension, yet, as the thickness must be reduced in order to retain the same weight, a limiting ratio of diameter to thickness is soon reached, which cannot be exceeded without danger of the tube failing through buckling induced by some local stress due to dents, etc. This ratio is much smaller when the tubes are curved, as in handlebars, which, if made of too thin metal, will fail at the bend and not at the junction with the stem, where they ought to fail first if their strength is calculated from the bending moment only. In multicycles, where heavier tubes are necessary, the diameters may be considerably increased with great advantage to the general strength and rigidity. For tandem and triplet cycles the author makes tubes 25 per cent. larger in diameter than for single machines, which gives about 50 per cent. more rigidity for the same weight.

Aluminium Frames.—The advantages of aluminium and its alloys, as compared with steel, have been so often urged that a few facts may be interesting. The best aluminium alloys have about 16 per cent. less strength and rigidity when drawn into tube than a steel tube of the same weight and outside diameter; but owing to its much greater thickness, the aluminium tube can be made of larger diameter without danger of buckling. For handle bars aluminium has greater advantages; and if it could be readily plated it would be really valuable for this purpose. The difficulty of jointing is much against it in most cases. For the comparison of strength and rigidity the tubes tested were both 1 inch outside diameter, and practically of the same weight per foot; the steel tube was 20 gage, or 0.036 inch thick, and the aluminium alloy 12 gage, or 0.110 inch thick. The superiority of the steel tube was due to its greater mean diameter; making allowance for this, the strengths and stiffness of the two materials are nearly equal. The maximum stress in the steel tube was 52 tons per square inch.

* From a paper read before the Institution of Mechanical Engineers, England.

and in the aluminium alloy 18.7 tons per square inch. The effect of a brazing heat was to reduce the strength of the steel by 45 per cent., thus bringing down its maximum stress to 28.6 tons per square inch; the stiffness was unaffected.

Testing of Tubes.—In testing tubes it is necessary to take special precautions in order to avoid buckling by local stress. For example, if the tube is supported at the ends and loaded at the center, it should be of considerable length, say 3 feet for 1 inch diameter, and the load should be suspended by a broad leather strap, so as to distribute the pressure over a large surface. Through the neglect of these precautions the results of many published tests have been rendered entirely misleading. The advantages so often claimed for "webbed" tubes are apparent only when the tube is tested in short lengths and loaded in the center. Under these conditions a plain tube is crushed in at the point where the load is applied, which is also the point of maximum compression stress due to the bending. It therefore fails prematurely from a local stress, which has no counterpart in the working stress of a cycle. When tested with proper precautions, webbed tubes are both weaker and less rigid, weight for weight, than plain tubes, a result which accords with theory. It is in many cases better to test by brazing a solid plug into one end of the tube, and having clamped this end, to load the other end; in this way all unfair stress is avoided. Corrugated tubes have the advantage of resisting local stress better than plain tubes; but they are less rigid, weight for weight, and present difficulties in jointing. Nickel steel is as rigid as carbon steel, and has the advantage of a higher elastic limit; it is therefore well suited for the two front tubes of a cycle, which are the most subject to vibration. In other parts, where the elastic limit is not so nearly approached, it has no advantage over ordinary steel. It is a mistake to suppose that the mildest steel is the safest under vibration; owing to its low elastic limit, it is more liable to break off short from vibration than harder steel containing up to 0.8 per cent. of carbon.

Means of Securing Rigidity.—In considering the design of a safety bicycle frame, too little attention is generally paid to what may be called the driving stresses; that is, those set up by the pressure of the foot upon the pedal, which causes lateral distortion of the frame. There are two distinct cases to be considered—first, when the pressure of the foot is balanced by a pull at the handle on the same side; and second, when there is no pull at the handle. In the first case, when the pressure of the foot is balanced by a pull at the handle on the same side, the distortion is confined mainly to the front part of the train, consisting of the head tube, the upper and lower front tubes and the seat socket tube. Each member of this quadrilateral is subjected to both torsion and bending. If any one of these members is so strengthened that its bending and twisting are diminished, then the strength of the adjacent members is also increased, so that much greater forces are required to produce a given distortion. Now the head tube being short compared with the other members, an increase in its thickness is accompanied by an increase in the stiffness of the frame out of all proportion to the increase of weight. This stiffness is also increased up to a certain point by shortening the head tube. The torsion of the seat-socket tube is greatly diminished if the rear part of the frame is rigidly connected, instead of being merely bolted together. When the torsion of the head tube and seat-socket tube is thus minimised, rigidity is secured by providing top and bottom front tubes of suitable diameter and thickness. In the second case, when the pressure of the foot is not balanced by a pull on the handle, the distortion is not confined to the front part of the frame, but every member is twisted and bent simultaneously. The rigidity thus depends mainly upon the joints throughout the frame. In a machine wanting in rigidity, the wheels and the frame are no longer in the same plane; the wheel inclines to one side of the vertical, and the frame to the other, and the direction of the inclination alters at each stroke of the foot. The stresses thus set up are much the same as if the wheels were fixed, and the frame twisted by means of the seat pillar. If the joints are made merely by flattening the ends of the tubes and then bolting up, the frame is liable to be rickety, because under bending and twisting stresses such joints will give more than the whole length of the tube. This source of weakness is avoided in the author's practice by brazing the back forks and chain stays together, without any flattening or weakening of section, and by reinforcing the joint with a wrapping of sheet steel. At the junction of the seat-socket tube the back forks are also brazed on, and the solid end-piece, after brazing in, is recessed to take the seat-pillar bolt. This connection is so rigid as to permit of dispensing with the usual bridge above the back wheel. In the same way the ends of the front fork are stiffened so as to increase the lateral rigidity as compared with the usual make of flattened tube fork end. In the fork crown the weakest feature of the ordinary double-plate pattern is the smallness of the brazing surface, which sometimes results in the tearing apart of the joint. This is remedied by fitting the fork blades into a practically continuous socket joining the crown plates.

Chain Stays.—The chain stays are perhaps the most important part of the frame of a cycle. Before the extreme importance was realized of a narrow tread for constituting a straight-running machine, round chain stays of 7/8 inch diameter were often used, which gave ample stiffness; but now that there is a premium on every 1/8 inch under 5 inches clear width between the pedals, it is necessary to reduce the diameter to about 5/8 inch. Now a tube of round section 5/8 inch diameter is only about half as stiff as one 7/8 inch diameter of the same weight, and has only about 70 per cent. of the strength. It therefore becomes necessary to use a section giving greater rigidity and strength than the ordinary round tube. The choice lies between oval, rectangular and D sections. The last of these has been chosen by the author as the most suitable. The weight of the rider puts the chain stays in tension; but this tension is small compared with that produced when the foot is exerting its maximum pressure on the pedal. The nature of the deformation produced by the chain tension may be investigated by tightening up the chain, and then squeezing its upper and lower spans together. It will be seen that both of the chain stays are thereby bent towards the chain side, because, being connected by the back axle, one cannot move without the other; and the final result is a bending in four places, two on each side—namely, close to the bridge and close to the back axle. The chain stays designed by the author are shaped with a slight bend in the middle, so as to clear the crank end. This construction has been criticised as causing a bending moment at that point, tending to buckle inwards the stay on the chain side; but experiment shows that the total bending moment is not a maximum at that point, and that consequently the slight inward bend does no harm. On the other hand, a sharp bend near the bridge is a source of weakness, which is best guarded against by using a steel casting at this point, instead of merely bending the tube. The bending moment, which is due to the back axle not being exactly in line with the back forks in some portions of the "chain adjustment," amounts in extreme cases to about 70 inch-pounds, which means only a small stress on the D tubes that are used. The stress, moreover, is perfectly symmetrical, and causes no lateral distortion of the frame. The advantage claimed for the radial or swinging adjustment—namely, that the axle is always in the center line of the back forks—is thus of small account, and is far more than counterbalanced by the want of lateral stiffness in that adjustment. By the "chain adjustment" is meant the path of the back axle along the slot provided for the purpose of adjusting the tension of the chain; when the back forks are bolted to the axle the weight of the rider is taken direct by the axle; but when the frame is brazed together at this point the axle moves away from the point where the center lines intersect.

D Tubes.—On the subject of D tubes for chain stays, there exists some amount of misapprehension. They were intro-

duced by the author partly because the flat inner surface is convenient for the nut on the back axle to be locked against, and partly because, for the same width and weight, they are more rigid than either round or oval tubes. In order to attain the requisite rigidity, it is necessary in general to increase the section of chain stays beyond what is required for mere strength; it is therefore the rigidity of the different sections that has to be compared, and not their strength. It has been argued by a recent writer on cycle construction that, weight for weight, a tube of semi-circular section is only 1 per cent. stronger than a tube of circular section, if both are of infinitesimal thickness. Now the D tubes employed by the author are not of semi-circular section, and they are at least 20 gage, or 0.036 inch thick. A semi-circular tube is about 16 per cent. stiffer than a circular tube, weight for weight, if both are of infinitesimal thickness; and when the thickness becomes finite, the advantage is still greater. A ⅝-inch semi-circular tube of 20 gage, or 0.036 inch thickness, is about 25 per cent. stiffer than a ⅝-inch circular tube of the same weight, since the thickness of the latter must be about 17 gage, or 0.054 inch, and its mean diameter is therefore less. The section used by the author, however, is not semi-circular, but much more resembles the shape of the letter from which it takes its name. Theoretically, a rectangular section is the best possible; but its appearance on a cycle is so hideous as to be out of the question. If for equal weight the relative stiffness of a tube of circular section, ⅝ inch diameter and about 17 gage thickness, be represented by 100, then the results of tests of oval and D and rectangular sections, all three rolled from a round tube of 15-16 inch diameter, will compare as follows:

Round tube, 0.65 diameter × 0.054 thickness, relative stiffness 100.

Oval tube, 0.65 wide × 1.125 deep × 0.036 thick, relative stiffness 119.

D tube, 0.65 wide × 1.070 deep × 0.036 thick, relative stiffness 136½.

Rectangular, 0.65 wide × 0.325 deep × 0.036 thick, relative stiffness 146½.

It will thus be seen that the D section now adopted is only about 7 per cent. less stiff than the rectangular, which is the best that can be rolled out of a round tube of the same diameter and to the same width.

Multi-cycles.—The necessity for lateral rigidity is even more apparent in multi-cycles than in single machines. It is found that any want of unison in the efforts of the riders has a disconcerting effect, which greatly detracts from the pace and from the power of going up hills. It is only by the employment of tubes of larger diameter that the increased distorting stresses can be properly met. The form of frame now generally adopted was first used by the author in 1895, and has for its principal feature a horizontal tube running from the bottom of the head, parallel with the top tube which starts from the top of the head; the lower line of tube is braced by means of light diagonals to a single bottom tube of 1¾ inches diameter. This form of frame, whilst not superior in strength or rigidity to that having diagonals running from the top tube to the bottom without an intermediate tube, possesses a great commercial advantage in the fact that frames can be built of different hights without altering the angles of the lugs simply by raising the top tube. It is advisable to unite the rear end of the intermediate tube to the back forks by a short fork, which increases the lateral rigidity. There seems to be a general tendency to duplicate the back fork in multi-cycles; but greater rigidity can be secured by means of a single fork of large section, provided that it is properly connected to the top of the rear seat pillar lug. In the same way a single tube of 1¾ inches diameter connecting the various crank brackets gives greater rigidity than the more usual arrangement of two 1-inch tubes, placed either side by side or one above the other. The method devised by the author, of fixing the back axle by nuts locking against the inner surface of the chain stays, gives a rather wider spread to the back forks than is usual, which is an advantage in improving the bracing between the axle and the seat-pillar lug.

Chains.—The great advantage of a roller chain, when exposed to mud or dust, led the author to consider why the block chain was so generally admitted to be the faster of the two; and the conclusion he came to was that it is a question of smoothness of running. The roller-chain links were at least 1 inch long from center to center of eyes, whilst those of the block chain were alternately 0.4 and 0.6 inch. By shortening the links, therefore, to ½ inch, he concluded that the roller chain would run more smoothly, and consequently be faster than the block chain. It was found, indeed, that roller chains of ⅝-inch pitch were already contemplated by the chain-makers; but as this length is slightly in excess of the longer of the block-chain links, there is no advantage in smoothness or speed. It was questioned whether the chain and wheel of ½-inch pitch could be made a success in practice, but experience has fully justified the expectations on this point. The smoothness of running with gearing of this pitch is remarkable, whilst its excellent behavior when covered with mud or dust renders a casing almost superfluous.

Gear and Crank Length.—The question of gear is so closely connected with that of crank length that they cannot properly be considered separately. For it is evident that a gear of 60 inches does not represent the same conditions with a 6-inch crank as when one of 7 inches is used; and similarly it would not be reasonable to expect that a leg 36 inches long will be suited by a length of crank which suits a leg 32 inches long. The length of crank must be decided by the rider's natural length of stride, and the ratio of multiplication of gear to length of crank must depend upon his muscular development; both of which data may be approximately ascertained by measurement. The gear is then the product of the two factors so determined. The maximum ratio of multiplication for road riding is about twelve times, and the minimum about nine times. The maximum length of crank may be taken as about 7½ inches, and the minimum 6 inches. Hence, the gear may vary from 90 inches down to 54 inches.

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The Place of Our Destination—XVII.

Editor American Machinist:

When one has had a project in his mind for years, gets part way through with it and has to abandon it, he is not likely to be, particularly if not in good health, in just that mood to get the best out of a ride through the country, though the country be the finest in the world.

Though now many weeks since we came from Berlin to Cologne—a long day's ride—I still have a remembrance that everything looked like well-tilled farms, pleasant villages, picturesque views, with windmills in them, and that the farm land was cut up into long, narrow lots, with grain and beans or potatoes alternate—no fences, but just alternate lots, perhaps four or six rods wide, of different things or different colors, as is the custom all through all countries where I have been, except our own. Whether it has been found that they get better results, or whether the landowners rent out the land to different farmers, as has been hinted, I don't know. If this latter, one may wonder how our American farmers would get along without a fence between his own and his neighbor's. It's a funny thing, isn't it? that when a man gets anything of his own, the first thing he wants to do is to get a fence around it, and it doesn't matter whether it's a farm or an invention, fence it in he must, and the money wasted on fences and patents is appalling.

Our ride brought us across the western half of Prussia, and besides the farming country, we came through, when nearing the Rhine, Bochum and Essen—the former one of the places where the finest steel castings were made, and an exhibit from there at the Paris Exhibition of 1867, astonished the metal workers of the world—twenty-two car wheels cast in one piece, the wheels sitting hub upon hub in a string. They had mastered one of the secrets of steel casting even in that early day—the ample riser.

Bochum and Essen, where the great Krupp works are located, are near each other, and one thing that struck me as very strange was the absence of all evi-

dences of the presence of large industries. All around Birmingham, Manchester, Sheffield, Glasgow and Pittsburg one need not be told that he is in the midst of great iron industries, but at Essen, aside from a single rolling mill, which I fancy was not a part of the great Krupp works at all, there was no more to show that one was in the vicinity of the greatest works in the world than one finds at the entrance to the Bollincx Works in Brussels, or at the Phoenix, at Ghent, to show that they are machine shops. What a disappointment to think one has passed through these places and seen nothing but a couple of German towns.

Soon after we struck Dusseldorf, and from there retraced our track of a month before through Cologne, where we spent a day to rest and enjoy the city and the Cathedral, and through Aix la Chapelle and Liege to Brussels.

Here, being detained a couple of weeks to see an engine started, we worked about as hard as we well could in doing nothing but rest up, and learned, by the way, two Belgian sayings: one that, "If a man gave you his word of honor as a mechanic that a thing would be done to-morrow that you could expect it in just a fortnight," and the other, "If you tell a Belgian that you want a thing to-morrow his reply is that 'If you want it to-morrow you should have ordered it sooner.'"

During many forced visits to the far-off Congo village annex of the Brussels Exposition at Tervueren I took occasion to look more into the single-rail railroad, which seems to me the biggest fool affair I have ever seen, though perhaps no worse than two or three in the same line experimented with in our own country. To fill the columns of the "American Machinist" with a description of such a monstrosity is only justifiable on the ground that it may help to prevent repetitions or the promotion of schemes of a similar sort.

To begin with, the ties are about twice or more times as far apart as in an ordinary road, giving, of course, so much less ground support. Upon the ties are erected A frames of angle iron, bent to fasten to the ties and forged at the upper end to fit and rivet to a double-headed rail 8 or 9 inches deep; this is the one rail. On each side of the A frames are two other rails to take the guide wheels for holding the car upright and to take the centrifugal force on the curves. Then, again, at the bottom there are two other light rails for conducting the electric current, so the one-rail road has seven rails, and it seems to me the cost must be two or three times that of a common two-rail line.

Astride of this track is an electric car, perhaps 40 feet long, and in the pockets on each side are located the electric motors. The car has four carrying wheels only 4 feet in diameter, upon which the load must be rather excessive, the wheel covers coming up into the car, splitting it in two and necesitating the placing of the seats back to back along the center, an awkward position for people to get any pleasure out of travelling. At one part a section has been fitted up in royal style for the king, if they can prevail on him to take a ride.

What a nice thing to deal with would be a switch in such a line; there is none in this; the whole structure for 50 or 60 feet would have to be swung over at least 5 feet at the end for the car to clear.

All this extra cost and trouble to accomplish one thing, to prevent running off the track, which it could not do with everything in perfect condition, and that seldom happens with the present system. Head-end collisions could not occur, neither can they on any double-track road, and tail-end collisions can come equally to each. Great hopes must have been entertained by some one on the success of this project. A station was built, an avenue set out with trees leads up to it, a bridge over a street has been put up, and from 800 to 1,000 electric horse-power provided to drive this one car. One hundred miles an hour was the objective point, about 60 at certain times had been obtained, and the breakdowns, alterations, bothers and waits even at this time when two-thirds of the period of the exposition had expired, were about in proportion to the ridiculousness of the whole scheme.

In the power house, where the electricity for this railroad is generated, and for the lights for the grounds and even for the main exhibition eight miles away, a fine group of engines is in service, and besides as fine a collection of locomotives as was shown in Chicago, and, too, in about as great variety, though all of the regular present-day machines—none like the standard American locomtives, but such as are used in Belgium and the countries round about. Among the many compounds was one with the high-pressure cylinders conected to one axle and the low pressure to the other. Why, with this method it would not be as well to leave off the side rods (the very thing that engineers most want to get rid of) I cannot see. And, too, it might do to leave out the intercepting valves, the slipping of the front wheels (if the engine did not start by high pressure) for a half turn or a turn would bring up the pressure in the intermediate receiver. A narrow-gage electric railroad runs around this part of the grounds, which are very extensive. A hundred natives from Congo are established in a village of their own kind within the grounds, and several times a week a naval battle is fought with real war vessels in miniature, driven by storage batteries; a fort is battered down and a ship blown up to the edification of the boys, old and young.

The Thomson-Houston electric road, that runs from the main exposition, has a peculiar arrangement of trolley wires, one over the center of the out-going track as usual, and the other wire within a foot of it. To reach this wire the trolley pole runs out sideways from the cars. It works better than one would suppose, and worse than passengers could wish.

At the main exposition everything has reached a finished appearance, and the foreign nations, such as the French, Swiss and Italian, set examples in certain ways that we ought to have sense enough to follow, or be forced to follow in our hoped-for display in Paris in 1900. The success in the architectural display at Chicago was due to the fact that the architect-in-chief insisted upon all the main buildings being of one general hight and style, and the same color.

The entire group of the French exhibit at Chicago, which is the case at Brussels, was inclosed within a space, surrounded and embellished in a single architectural style. The Italian exhibit of statuary at Brussels has nothing to show that the exhibit is made by different artists; it is simply one grand display. The individual interest is sacrificed so far as display is concerned to the glory of the whole. So, too, the Swiss watch industry is made a single exhibit; all the showcases are alike and together, and one not in the trade would not mistrust but what it is the display of a single exhibitor. Where, as I explained, twenty or more exhibitors exhibiting as many articles, had combined to make a single display at Stockholm, here nearly as many in the same industry have done the same thing. Perhaps our American exhibitors cannot be made or induced to do these things, but the powers in charge can insist on architectural embellishments so as to make one grand whole of the American section, and so, too, they can make the display creditable by rejecting trashy exhibits and tawdry displays.

On a second visit to the Bollinckx works I was astonished, as I was at Ghent, at the great number of boring machines, compared to what is found in our shops where similar work is done. This I found they levelled up this way: Two boring machines, alike in every way, were at work on Corliss engine cylinders, one boring as usual. On the other a similar cylinder was mounted on spiders on the boring bar, and movable compound rests were secured to the base plate, converting the machine into a lathe for facing the ends.

The little device illustrated in the "American Machinist" some time ago, used by Mr. Bollinckx to determine the cutting speed of machine tools, can be nicely arranged to fit our units of feet by putting a wood wheel six inches in circumference, about 3-64 less than 2 inches in diameter, on the stem on any speed counter. This when held on the piece being planed, faced or turned, for 30 seconds will truly indicate the cutting speed per minute. Even a more simple one

can be made by holding the wheel in any sort of a handle so it can rotate, having a plain zero mark on it, and count the revolutions for a half minute; the result will show the cutting speed in feet per minute.

The Lord Mayor of London was in Brussels while we were there, and we had a chance to see what the Belgians could do in the way of jollification. The King was away for his vacation and did not come in to see us; he sent his regrets, however—to the Lord Mayor.

JOHN E. SWEET.

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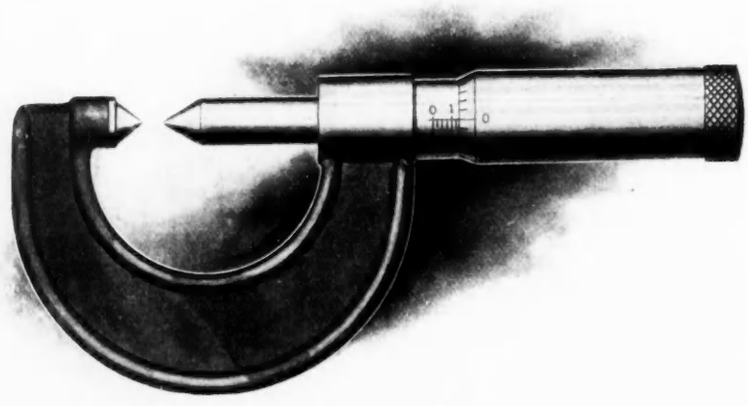
Screw-Thread Micrometer Caliper.

We present herewith a new form of screw-thread caliper, which is made with pointed contacts instead of the usual flat ones. It is of course well understood, that owing to the fact that these points are directly in line with each other, this micrometer will not determine the actual diameter of a screw thread, but will make sufficiently accurate comparisons between



SCREW-THREAD MICROMETER.

two screws of similar nominal diameter and pitch, and serves very well to produce a screw for instance the same size as a tap or a few thousandths smaller or larger, the error arising from very small differences in diameter, not being usually appreciable.

The measuring tips are not brought to an absolute point, but are flattened to about $\frac{1}{64}$ inch in diameter, and the caliper is adjusted to zero when these points are in contact, so that when desired to do so it can be used the same as any other micrometer, or at the bottom of a groove, or in recesses, in such jobs for instance as the measurement of the thickness of twist drills at the center or for similar work.

The caliper is also furnished when desired with a V shaped anvil, made to embrace a screw thread, so that actual diameters can be measured by contact with the sides of the thread and without reference to the outside diameter of the screw. Made thus, however, its application is somewhat more limited. The caliper shown is made by J. T. Slocomb & Co., Providence, R. I.

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The Honduras Syndicate and Its Powers and Duties.

During the last session of the Honduras Congress, which closed on April 10th ult., a concession for the completion of an interoceanic railway was granted to the Honduras Syndicate, of New York. This syndicate is composed of Chauncey M. Depew, W. Seward Webb, John Jacob Astor, Benjamin F. Tracey, J. G. McCullough, Frederic B. Jennings, George S. Scott, Nathaniel A. Prentiss, Charles McVeigh and Melville E. Ingalls, Jr. This syndicate is represented in New York by Henry L. Sprague and W. S. Valentine.

This concession was granted so that the syndicate should undertake the construction of a railway from Puerto Cortez, across country to Amapala, on the Pacific coast.

The concession includes a railroad at present in operation between Cortez and La Pimienta, a distance of some thirty miles, together with all its appurtenances.

A subsidy of 100 feet of land is granted on each side of the road; if this happens to be private lands, the government will pay for the land and the syndicate will pay for the improvements. Where it must pass through closely inhabited sections, only one-half this width of land will be granted.

For every mile of railroad which it constructs the syndicate will receive five square miles of land; where it passes through public lands, these grants will be contiguous to the road; but should it pass through private property, the syndicate may choose, any time within five years from the date of contract, from the public domain, the quantity of land to which such mileage will entitle it.

The concession calls for the construction of a branch line from Puerto Cortez to Tigucigalpa, under similar conditions to those named above.

The right is granted to use all material needed that may be found on government land free of charge, provided previous rights have not been granted to other parties.

It is required that five miles of this road shall be constructed in the first year, 25 in the second, 50 in the third. In the fourth year it must be built to Comayagua, a distance of about 200 miles; the entire line to be completed and open for traffic at the end of six years. If these conditions are not met, the government will be entitled to 15 per cent. of the gross receipts of the road until such time as it shall be completed, an extension of time being granted in which to complete. In the event that it should fail to be completed at the end of the time thus extended, then the road shall pass into the hands of a trustee.

As a return for these concessions, the government mails are to be transported free of charge, and the officials shall also travel free; the tariff on transportation rates on Central American products shall be the lowest possible; no customs dues shall be charged on either persons or freight engaged in or transported on account of interoceanic intercourse; all material for the construction of the road shall be admitted free of duty, and all employés, except Chinese and negro labor, shall be exempt from personal tax for ten years after entry.

Bonds may be issued by the syndicate up to $20,000 in gold for each mile of road; but no foreign government may be a purchaser of same.

After the road has been in operation seventy-five years, the government may purchase same, and this right may be exercised at the end of any successive five years thereafter, although it is definitely arranged that at the end of ninety-nine years it shall become the property of the Republic.

The syndicate obligates itself to liquidate the public debt of Honduras, and it is intended to open offices in London, Paris and New York.

It is to establish a bank, to be called the Commercial Bank of Honduras, with a capital stock of $500,000 in shares of $100 each. This bank will act as the financial agent of the government, and will be the depository of the national funds; it may also coin money. The net profits, should there be any, will be equally divided between the syndicate and the government; but nothing is said in the reports received as to what would be done if the returns should show a deficit. Mortgages may be granted by the bank to one-third of its capital, upon which interest may be charged up to 15 per cent. It is also provided that it may make loans, issue notes and guarantee government bonds. There will be five directors, with an additional one appointed by the government each year.

The bank was to take charge of the

custom houses of the country on October 1st last, and the government has obligated itself not to reduce its tariff rates for the next fifteen years. The railroad and bank capital will be exempt from all taxation.

A. F. TENNILLE.

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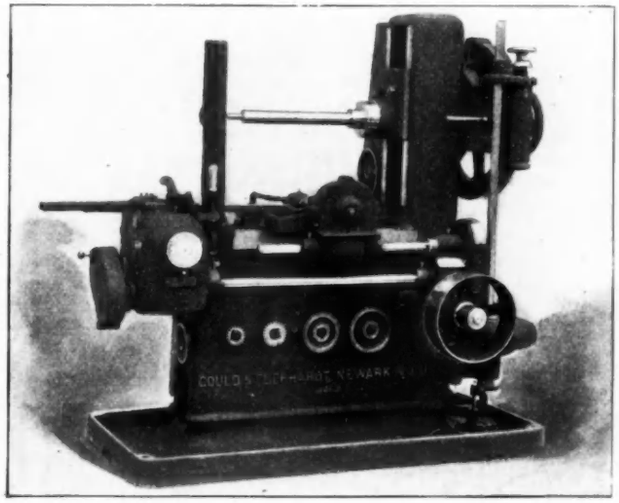
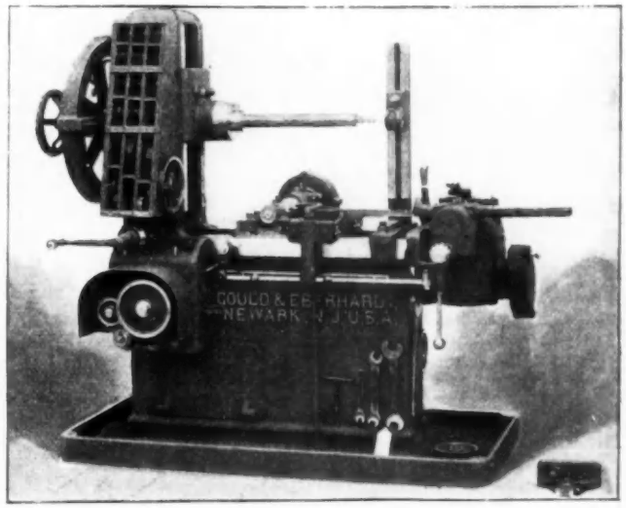
Quick Work.

When a rifle is placed to the shoulder and the trigger pulled, the time that elapses between the fall of the hammer and the flash at the muzzle is so brief that it appears to our senses to be perfectly instantaneous. Yet, during this time the firing pin was moved forward and exploded the percussion cap, which, in turn, has fired the powder charge, and a certain period of time has been consumed in the combustion of the powder; the projectile has been started, at first slowly, and then forced along with accelerated velocity to the muzzle, and as the projectile moves away from the muzzle, the powder gases, rushing out at a much higher velocity than the projectile, impinge upon it, and are thrown outwards at right angles to the gun in the form of a disk, in exactly the same manner as though the projectile were held stationary in that position. Such, in spite of the evidence of our senses, is the relativity of velocities and time.—"Journal U. S. Artillery."





AUTOMATIC GEAR-CUTTING MACHINE.

The Eberhardt "Victoria" Gear Cutter.

We do not know whether the name of this gear cutter is made for British consumption or not, but many of them are being installed in the Queen's dominions. The half-tone shows the latest automatic gear cutter of Gould & Eberhardt, Newark, N. J. It is the smallest size of their new type machines, cutting gears up to 28 inches diameter and 9-inch face. It is designed to cut teeth as large as 4 diametral pitch, although the writer saw it working along very smoothly cutting a 2 pitch chrome bronze wheel about 18 inches diameter and 5 inches face for a disappearing gun carriage mechanism. All the movements of the machine, the revolutions of the cutter, the feed and return, and the automatic dividing, are derived from one pulley and one belt, splined shafts providing for the movements on the various slides. The changes in cutter speed, feed or number of teeth cut, are made by gears which are slipped on or off without the use of nut, screw or wrench. Each set of gears is of a different pitch and each set is hung near the place where it is used.

The large worm wheel for dividing is made in halves, and the correctness of the divisions is assured by the separation of the halves and the moving of them around to other relative positions. A lever is provided which lifts the worm out of gear and allows the gear to be turned freely around for inspection or any other purpose. The indexing train is not thrown out of mesh, so that the gear may be turned back to its correct position for cutting. A micrometer adjustment provides for slight movements of the wheel either way, for dressing teeth on one side or correcting the relative position of the cutter as desired. The worm and wheel, as, indeed, all the gears, are entirely encased and protected from dirt or flying chips.

A spiral rack is used instead of a screw for driving the cutter slide, allowing an unusually quick return. The rack is so placed as to have a direct central thrust or pull on the cutter slide. The cutter may be fed through the cut or returned by hand by means of the ratchet lever hanging down at the right hand of the front of the machine. This lever is detached and hangs free except when the engaging pawl is held in gear by a slight end thrust on the lever. Every movement in cutting is complete in itself, and unless all previous movements are fully and correctly completed the next one cannot be made. The movement of the dividing wheel must be completed before the cutter carriage can commence its work. The cutter must have traversed its entire length and ceased cutting before it can return, and must be back in position ready for the next cut before the gear moves to the next tooth. Unless the division is made complete the cutter carriage cannot possibly feed forward. This action always takes place automatically and requires no adjustment for any size of gear. The feed may also be instantly thrown out by hand. A support which rests central on the sliding surface holds the outer ends of long gear mandrels, and in changing the work this may be slid back and the alignment retained. The gears, with the exception of the pair connected with the worm direct, are on fixed centers, so that when the gears are changed no adjustments for distance are required. Bearings are of phosphor bronze, and all sliding surfaces are scraped to surface plates. Oil tubes are provided wherever necessary, and an oil pump provides a flood of oil for the cutter. A large oil pan forms the base of the machine.

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Netherlands Import Duties on Ventilators.

Under date of October 1, 1897, a ministerial order of the Netherlands provides that ventilators, exhausters and bellows, which are worked by either steam, gas, petroleum or electric motors only, and are intended for use in factories or on ships, and only in exceptional cases elsewhere, may, for these reasons, be admitted free of duty.

Ventilators for ordinary ventilator purposes, and operated by any other motive powers than those mentioned above, will remain subject to the duty prevailing prior to that date.

A. F. TENNILLE.

Device for Turning Slender Metal Articles.

The device which we here illustrate is an application of the turret, or revolving tool holder, principle. The primary design of the apparatus is for turning slender metal work, such as shown in Fig. 1, the difficulty of which will be appreciated The profile of the work may consist of straight and parallel lines, or it may be of curved or irregular outline. The axis of the cylindrical tool holder, which is supposed to be attached to one of the familiar types of automatic screw ma-

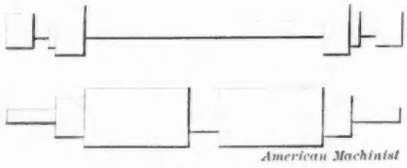

Fig. 1

chines, is carried parallel to the axis of the work instead of at right angles to it as with the standard turret, and the cutting tools which it carries approach the work sidewise, instead of endwise, of the revolving stock.

Fig. 2 will give an idea of the tool holder and tools, and of the means for holding them. The drum or cylinder, *F* being one end view of it, is as long as, or longer than, the piece to be turned. It may be made to carry any required number of cutters. If, say, six cutters are used, three will be inserted from each end. The last tool on one end will be a cutting-off tool, or will have the cutting-off tool as a part of it. The counterbores *K* will extend in to one-half of the length of *F*, or a trifle deeper, so that the cutters may overlap, and not leave a burr between the two cuts. The washer *N* and cutter *M* are inserted and fastened by the bolt *P*, the nut of which is sunk in a

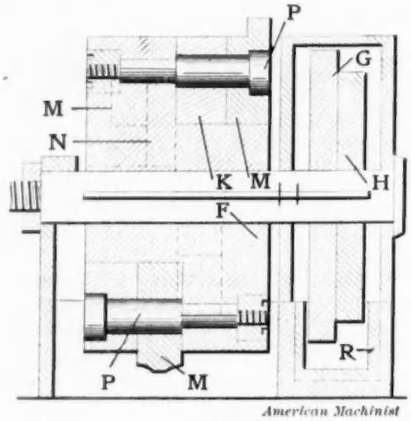

Fig. 3

counterbore on the other end of the cylinder. If the washer *N* is placed in the counterbore first, and the cutter *M* outside, that will bring the first cutter at the end of the cylinder, as shown. A shorter washer in the next counterbore will bring the next cutter farther in, and if all the washers are placed outside the third cutter, its cut will extend to the center of the cylinder, and the three cutters on the other end will take the remaining cuts as required. The tools are made so that they may be sharpened by grinding the cutting face and then turning the point forward enough to bring it again to its normal position. The cutters must be made with care, as the diameters as well as the shape of the finished piece are determined by them.

The cutter cylinder *F*, Fig. 3, is carried in a pivoted frame *E*, Fig. 4, which, the cutters being below the work, is capable of vertical movement. The cylinder is keyed or splined to the shaft upon which it turns, and upon the same are also fastened a latch wheel *G* and a ratchet wheel *H*, which are employed to move the cutters successively into position and to hold them there while cutting.

Referring to Fig. 4, the operation of the cutters will be easily understood. The work to be turned *i* revolves in the die or guide *d*, which is cut away at the bottom to allow the cutters to get at the work. One of the cutters being in position for cutting, the frame *E*, which carries the cutter cylinder, is fed up to the work by a slow movement of the lever *T*. When the cut is completed, frame *E* is allowed to drop quickly; the sliding bar *R*, which is as far as it can go to the left, is moved to the right, with the result that the latch *S* is withdrawn from and releases the latch wheel *G*, and the pawl *W* acts upon the ratchet wheel *H* to bring the next cutter into position. The return of the sliding bar *R* allows the latch to again engage the latch wheel and lock the cutter, and also allows both pawls to resume their normal positions.

Fig. 5 shows the means for imparting to the lifting lever *T* and the sliding bar *R* the above mentioned movements. On the cam shaft of a screw machine, which shaft has both a fast and a slow alternate movement, are fastened the ratchet wheel *A* and the cam *B*, with the inwardly pro-

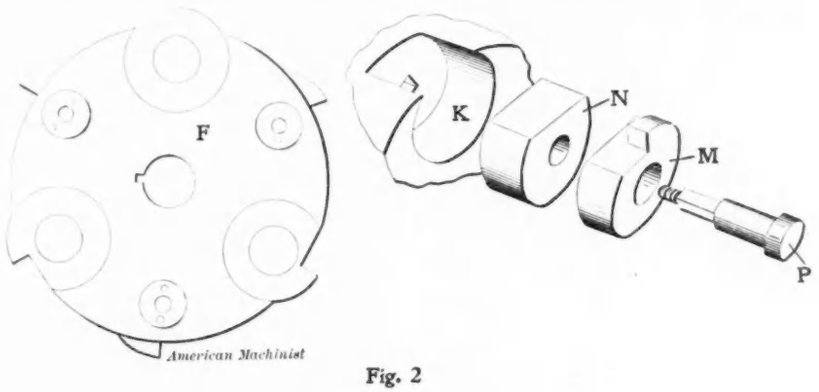

Fig. 2

jecting lugs *C*. The ratchet wheel acts upon the roller *D*, depressing the lever *I*, and this acts upon *T*, the other end of which raises the frame *E*, causing the cutter to do its work as before described. The cam moves slowly during this operation. When the cut is completed, the end of the ratchet tooth is reached, and the weight of *E* drops the cutter back. A lug *C* then engages the roller *O* on the lever *P*. This action moves the bar *R* to the right to advance the next cutter, and when the lug *C* has passed, the spring *U* pushes the bar *R* back to its normal position. The sliding piece *L* changes and adjusts the relative leverages of levers *I* and *T*. The rod from which the articles

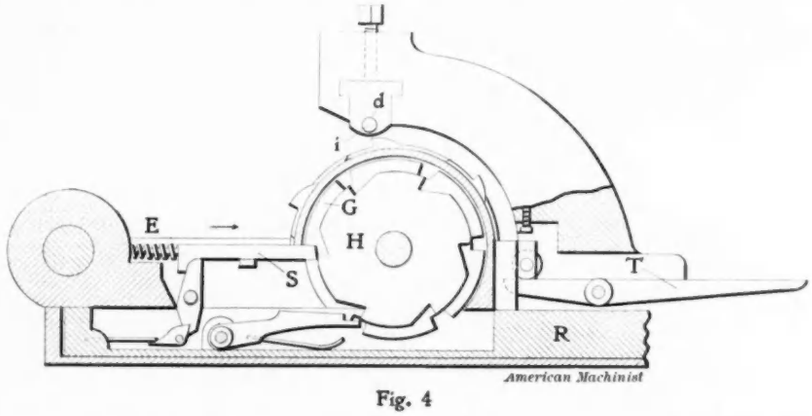

Fig. 4

are turned is assumed to be not only revolved, but also automatically fed along by the usual screw machine movements. The inventor is J. D. Mattison, East Orange, N. J.

Sexton's Omnimeter.

Of the making of slide rules there is no end. The most recent instrument of this class is Sexton's omnimeter, which is a circular instrument intended for all the usual uses to which the slide rule is put, but with some features added which the regular straight rules do not have.

The circular form has certain advantages, due to the scale doubling upon itself, and being its own repetition, after the manner of a clock dial, and also to the fact that the scale, being upon a circle, is π times as long as the diameter of the instrument. The diameter of this instrument at the edge of the A and B scales is 6 inches, which gives a scale of the same degree of openness as a straight instrument 19 inches long, if with a single scale, or 38 inches if with two. With this length of scale, results can be read to four places, if slightly more than 1, or three places if slightly less. Circular instruments have been made before, but usually with the idea of taking advantage of the increased openness of the circular in form to reduce the size of the instrument and bring it down to dimensions suitable for the pocket.

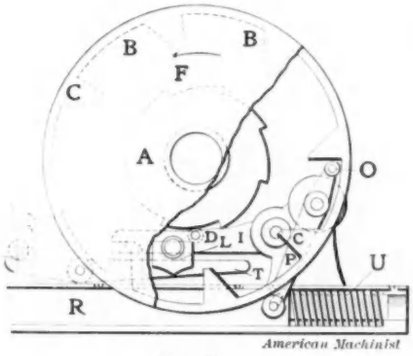

Fig. 5

The omnimeter consists of a foundation plate containing the A scale, and also a scale for reading logarithms. Turning on a pin at the center of the plate is a disk and a radial transparent arm. The disk carries the B scale, and inside of it a series of additional scales, some of which extend the scope of the instrument beyond that of the common slide rule; while other problems which can be worked upon the common rule are more readily solved by the omnimeter. The scales of the disk are alternately for trigonometrical functions and for powers and roots. The trigonometrical scales are tinted in red, while the numerical ones are in yellow—this distinction of color assisting the eye in keeping to the proper scale. The trigonometrical scales give secants, sines, tangents and versed sines, while the numerical scales give squares, cubes and fifth powers, with the corresponding roots. The readings are carried from scale to scale by the radial arm, which carries a fine line for the readings. This radial arm serves the same office as the runner of the common slide rule.

The values of the trigonometrical functions are found by setting the arm over the degrees and minutes of the required scale, when the natural function may be read at once from the B scale or the logarithmic function from the scale of logarithms. In addition to giving functions which the common rule does not, the instrument enables those functions to be read much more readily. The reading for a sine, for example, through the notch on the back side of the common rule, with most of the figures of the scale covered up, is anything but satisfactory. Moreover, with the omnimeter the radial arm is set for the function, and multiplication or division of it may then be performed more readily than with the rule.

The instrument is made by Theo. Altenheder & Sons, Philadelphia.

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Relative Proportions of Solid Shafts, Hubs, Sleeves and Hollow Shafts.

BY HENRY HESS.

Ordinarily when a hub has to be designed for a given shaft diameter it will do very well if made 1.75 to 2 times as large as the shaft. It occasionally happens that room is scarce, so that it becomes important to know how small the hub may be and yet be capable of doing the same work as the shaft. Such a case is illustrated by Fig. 1, in which a shaft drives a gear whose hub is carried through a bearing, on the other side of which it terminates in a clutch; as the framework of the machine comes up close it demands as small a sleeve through the bearing as is practicable.

The rule for a solid shaft is

$$M = \frac{\pi}{16} F d^3 \qquad \text{(I)}$$

M = the load moment, that is the product of the load in pounds into the radius in inches at which it acts.

F = the greatest twisting stress in pounds per square inch on the shaft.

d = the shaft diameter in inches.

The rule for a hub, sleeve or other shell is

$$M = \frac{\pi}{16} f \frac{D^4 - B^4}{D} \qquad \text{(II)}$$

f = the greatest twisting stress in pounds per square inch in the hub.

D = the outside diameter of the sleeve in inches.

B = the diameter of the bore in inches.

As the shaft and sleeve do the same work, their moments are equal, so that the equivalents of the moments from I and II may be written down as equal to one another, as

$$\frac{\pi}{16} F d^3 = \frac{\pi}{16} f \frac{D^4 - B^4}{D} \text{ which reduces to}$$

$$F d^3 = f \frac{D^4 - B^4}{D} \qquad \text{(III)}$$

It will be somewhat more convenient if, instead of considering the actual fiber-stresses F and f, their ratio for the materials of which the shaft and sleeve are made be taken; let $r = \frac{F}{f}$ = ratio of relative fiber-stresses to which the shaft and sleeve may be subjected. Inserting this in III gives

$$r f d^3 = f \frac{D^4 - B^4}{D}$$

which cancels to the general rule,

$$r d^3 = \frac{D^4 - B^4}{D} \qquad \text{(IV)}$$

In a construction like Fig. 1, in which the shaft diameter d is equal to the diameter of the bore B, d is to be substituted for B in rule IV.

If the gear of Fig. 1, instead of being

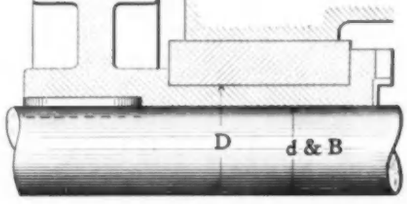


Fig. 1

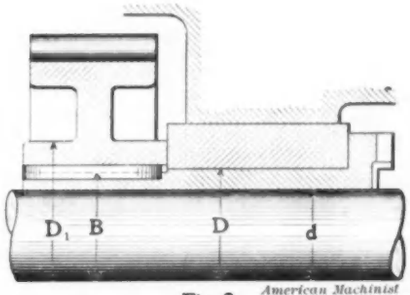
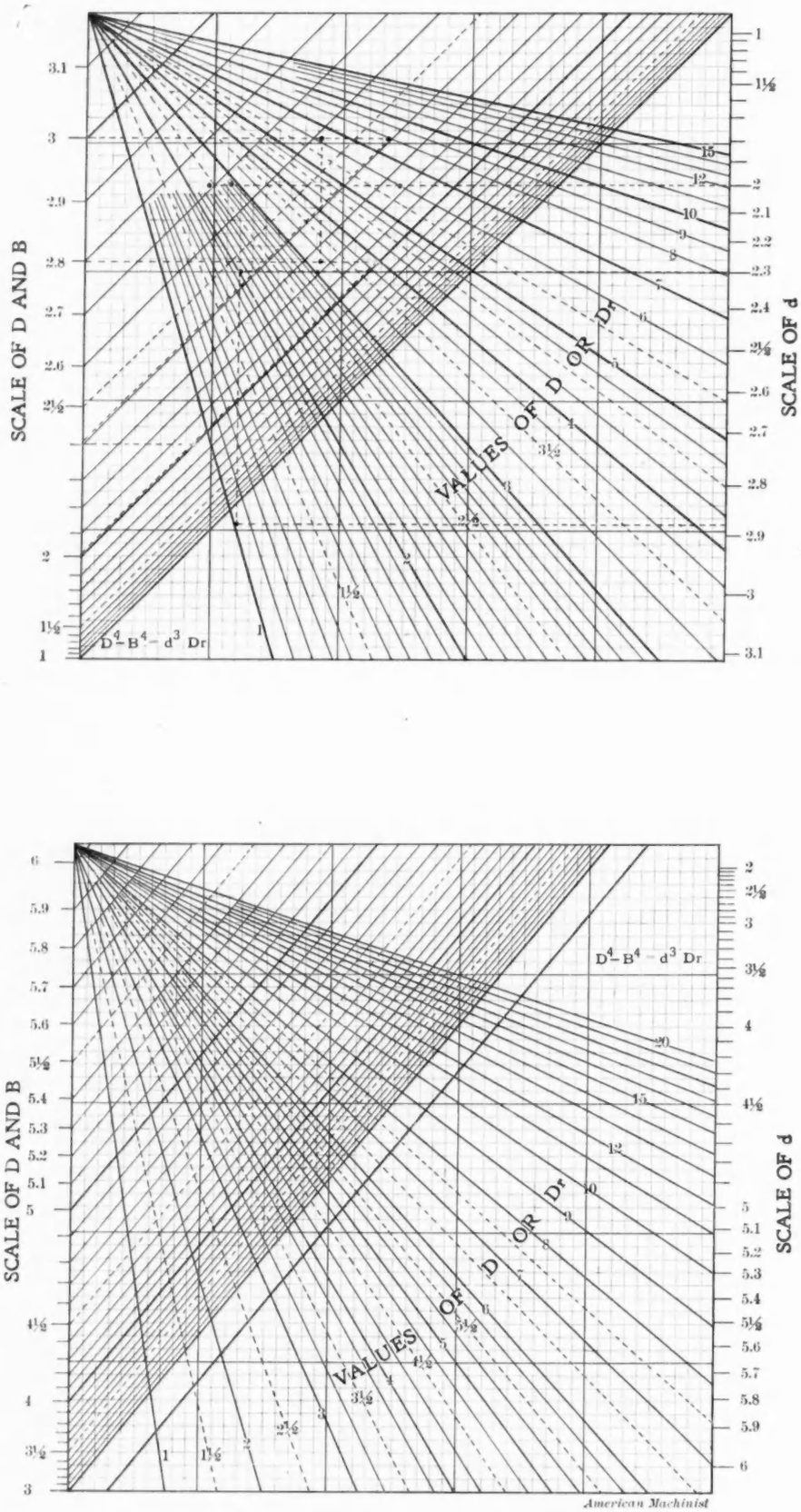


Fig. 2

made in one piece with the sleeve is keyed on the arrangement will look like Fig. 2, in which the bore B of the hub is no longer equal to the shaft diameter, but equals the outside diameter of the sleeve. As it has to transmit the same power as the shaft, rule IV applies.

Now, the solution of this rule, so as to find D, is so difficult that it is much more convenient, as well as rapid, to assume some value for D, to see whether it satisfies the rule, and if not, to keep on guessing closer and closer, until the right size is reached; the whole is rather apt to be a lengthy operation. On the other hand, there is a possible graphical solution that will occupy not more than a minute or two, in the tracing of a few straight lines on diagrams such as here given. Of these the first covers a range of D from 1 to 3 inches, the second from 3 to 6 inches.

In the following examples trace lines



SOLID AND HOLLOW SHAFT HUB AND SLEEVE RELATIONS.

have been dotted, and values spotted on the 1 to 3 inch diagram.

Suppose that the sleeve diameter D of Fig. 2 is to be found, when the shaft diameter is 2 inches; the shaft and sleeve are of the same material, so that the ratio r of their greatest fiber-stresses is 1, and may be disregarded, since it has no effect as a mutiplier. Hazard a guess that D is 2.8 inches. Mark the intersection of a horizontal trace from the assumed value, 2.8 inches, in the left-hand scale with that one of the parallel slants starting from $B = 2$ (the bore diameter) on the same scale. Then note the intersection of a horizontal trace from $d = 2$ inches (the shaft diameter) from the right-hand scale

DIRECTIONS.

D = outside diameter of hub, sleeve, or hollow shaft.

B = bore diameter.

d = solid shaft diameter.

r = ratio of greatest fiber stresses in parts of same resistance to twisting.

1. To find any D with a given B equivalent to a given d when $r = 1$: Spot the intersection of horizontal trace from assumed trial value of D with slant from known B. From known d trace horizontally to intersection with diverging slant-line marked with value of assumed D. If both intersections line vertically, the assumed D is correct; if not, make a second trial.

2. Same as 1, but solid shaft fiber stress is r times that of hub or hollow shaft: Proceed as for 1, but refer to diverging slant marked with product of assumed D into r.

3. To find various equivalent hollow shafts subject to same greatest fiber stress: The intersection of the horizontal trace from D with the slant from B will for every equivalent shaft lie in the same vertical line. The equivalent solid shaft diameter is at intersection with the lowest parallel slant, from $B = 0$.

4. To find diameter of a solid shaft equivalent to a smaller solid shaft w. ich is subject to a greatest fiber stress r times as large as is to be allowed for the new shaft: Refer known d horizontally to diverging slant marked with va ue of r, trace downward to slant marked 1, then back to scale for new d.

5. To find various hollow shafts equivalent to a given hollow shaft which is stressed to r times as great an amount as the new shaft: Reduce known hollow shaft to its equiva'ent solid shaft by method of 3. Then by 4 find equivalent solid shaft of lesser fibre stress. Then by 3 find various hollow shafts equiva ent to the larger solid shaft just found.

with that one of the diverging slant lines D, marked 2.8; if the value 2.8 guessed at for D is correct, this last intersection will be vertically in line with the first one spotted. They are actually quite far apart; as the intersection with the parallel slant lies to the right, the assumed value is too large. Try instead $D = 2.4$ inches. The two intersections are now very nearly in line; as the first one is now a trifle to the left of the second, this proves the correct value to be 2.4 +. A glance at the diagram shows that the trace from 2.5 has its intersection with the parallel slant much farther out of line, proving that the true value is much nearer 2.4 than 2.5 inches.

To find the outside diameter D of the gear hub when the material in the shaft

may be safely stressed twice as much as that of the hub: Here the ratio of the stresses r is 2. The diagram is used in a quite similar manner, only that instead of referring to that one of the diverging slants marked with the assumed hub diameter, intersection is made with that one marked with a value equal r times the assumed hub diameter. The known sizes are shaft diameter $d = 2$ inches, hub bore $B = 2.4$ inches, $r = 2$. At a venture, assume the hub diameter D as 3 inches. Then proceeding as before, except that reference is made to the diverging slant $D\,r = 3 \times 2 = 6$, find the two intersections very nearly vertically in line, proving the venture to have been fortunate; 3 inches is but a few hundredths small, since the intersection with the parallel slant is but a little to the left of the other.

This diagram is also very useful for finding the dimensions of all equivalent hollow and solid shafts under various relations of greatest twisting stress. As an example, assume that a 2.3-inch shaft is to be replaced by a 3-inch hollow shaft of the same material, and a bore which is to be found. From 2.3 at the right trace to diverging slant 3 inches; then vertically to horizontal trace from 3 in the left-hand scale; this last intersection is just below a parallel slant starting from 2.6; the diameter of the bore is therefore just a trifle under this size, but much nearer it than 2.5. For an outside diameter of 2.8 the bore is similarly found to be between 2.3 and 2.4 inches. Note that this intersection is vertically in line with the other; this shows that the intersections from the outside diameter with the parallel slant from the bore diameter are all vertically in line for shafts of equivalent twisting strength. If there is a question of the substitution of one metal for another the equivalent diameters are also readily found. Say that a 2.3-inch solid shaft is to be replaced by a shaft whose material may be stressed only one-half as much, so that $r = 2$. Trace 2.3 from the right-hand scale to the diverging slant marked 2, then down to the diverging slant marked 1, and back to the right-hand scale, where find the equivalent solid shaft to have a diameter of 2.9 inches nearly.

Condensed directions for the various uses to which the diagrams may be put will be found with these.

Although the mathematical solution of such an equation as that involved in the determination of these sizes is a very complicated matter, the construction of the diagrams is exceedingly simple. For the benefit of those who might wish to lay out some for themselves covering a different range of sizes or on a larger scale than is practicable for publication here, a descriptions is given. The equation IV may be transcribed as

$$D^4 - B^4 = d^3\,D\,r. \qquad (V)$$

The diagram is then so constructed as to first admit of the substraction of B^4 from D^4, and then of the multiplication of d^3 with $D\,r$; the product $D\,r$ is found mentally. The result of these two operations will be the same if the correct trial value has been assumed for the unknown quantity. The first thing to do is to lay off in a vertical scale of equal parts the various values of D^4 between such least and greatest D as the diagram is to cover. These values are best taken from a table of fourth powers, such as that published in Nystrom's or Molesworth's pocket books. Failing this table any ordinary table of squares may be used, remembering that D^4 is D squared twice. As a preliminary both the values of D^4 and the corresponding D are marked in the scale. On the left-hand scale of the first diagram (D from 1 to 3), for instance, each vertical division represents 2, so that 3^4, which is equal to 81, comes midway between the fortieth and forty-first divisions. In a similar way the right-hand or d scale is laid off, each value of d being written down at a position corresponding to d^3. The zero of this scale is taken at the top, because the origin of the various diverging lines must be on a level with it, and the diagram becomes more legible if these are arranged to cross the parallel slant lines. The horizontal distance between the two vertical scales may be anything; if made as great as the length of the side scales it will bring the whole into convenient square shape. Choose the unit length for the d scale so, that the scale for d will be about as long as the D scale. It will also be well to cover a range such that the largest d will be nearly the same as the largest D. The diagram will then cover the entire range from a shaft having a zero hole to a shell with very thin walls. Next from the various points of the D scale draw a series of parallel slant lines, preferably at an angle of 45 degrees. Then trace the top of the D scale horizontally to intersection with that slant starting from the lower end, and refer the intersection vertically to the bottom; then that length of the lowest horizontal included between the point just found and the lower end of the D scale will be equal to the difference of the actual values of these two points in the D scale. In this case the top of the D scale has a true value of 100 (since each vertical division represents 2, as stated before), while the bottom is zero; therefore that portion of the included lower horizontal is $100 - 0 = 100$. Its zero point is at the lowest point of the D scale. Note in pencil the values of the various divisions of this lower scale. They are readily found, as the scale is one of equal parts. The left-hand and bottom scales with the parallel slant lines now form a diagram for finding the difference between any two values of the vertical scale, the result being read off the bottom scale. As the vertical scale stands for values of D^4 and B^4 the difference found will be $D^4 - B^4$, giving one member of equation V.

Next multiply the actual value of the lower end of the d in right-hand scale with any value of B used. In this case the lower end of the d scale stands for 30; this multiplied by 3 gives 90. From a point in the left-hand scale at the same vertical hight as the zero of the right-hand scale run a slant line down to 90 in the lower scale, and mark it 3. In a similar way lay in slant lines for various values of D down to 1. Then the right-hand and bottom scales with the diverging slants form a diagram for obtaining the product $d^3\,D$, which is the other member of equation V when $r = 1$. As r may have various values, other slant lines for various possible products $D\,r$ should be laid down. As the bottom scale is one of equal parts, the determination of the direction of the various slant lines of D or $D\,r$ is a very simple matter. It is not profitable to go beyond an inclination of about one in five, owing to increasing inaccuracy of reading.

Since the bottom scale is common to both solutions, it follows that if the trial values assumed for the two sides of equation V are correct, they will give the same result in the bottom scale. As the diagram is to be used only to determine whether the trial values give this equality, without necessary reference to the numerical results, no readings of the bottom scale need be taken. The construction figures marked on it are therefore not inked in permanently.

▲ ▲ ▲

A Strike Insurance Company.

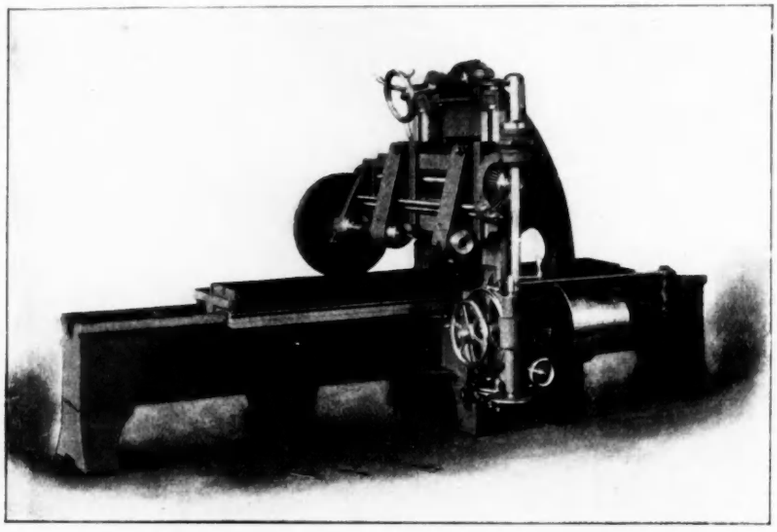
The latest idea from Germany is contained in a news item to the effect that employers there are organizing an insurance company, to be known as Industria, which is to have a capital of 5,000,000 marks, and the object of which is to insure employers against loss arising from strikes.

We do not know how such an organization may work in Germany, but it is safe to say that it would work very badly in America, because there can be no doubt whatever that the risk of strikes is very largely increased or decreased in accordance with the course pursued by employers; some employers having constant trouble from this source, while others in the same line of work, and similarly situated in every way, have no trouble whatever. An insurance scheme of this kind would, it seems to us, have a decided tendency to lessen such efforts as can be made to avoid trouble with employés, and it would, if generally entered into, throw the burden of a great deal of mismanagement in such matters onto the shoulders of those whose management and tact are sufficiently good to enable them to avoid serious difficulty of that nature.

But perhaps the company proposes to have a hand in the settlement of difficulties.

Horizontal Milling Machines.

We present herewith engravings of two horizontal milling machines both of which possess features of interest. The first of these is a machine which may be classed as of the planer type, since it consists essentially of a bed upon which is gibbed, to flat surfaces, the platen, which is moved between the uprights and beneath the cross rail, the same as with a planer. In this machine the bed is moved by the spiral pinion and rack movement, which has come to be known as the Sellers motion; this being in this case the feed motion.



SINGLE SPINDLE HORIZONTAL MILLING MACHINE.

Reference to the engravings will make the method of driving clear. There is a cone pulley at the side of the machine having three steps for 4-inch belt, the largest of these being 20 inches diameter. By a train of gearing this motion is transmitted to the opposite side of the machine to a large spur gear, which is on the cutter arbor spindle; the reduction by the gearing being in the proportion of 15 to 1, and the power thus obtained being amply sufficient for a cut 14 inches wide by ½ inch deep. The outer or main bearing for the spindle is movable upon the cross rail, the spindle sliding through the rear bearing and gear for this purpose, and the out-board support for the milling cutter spindle is also movable upon the cross rail, so that these bearings may be placed as close to the milling cutter as may be practicable or desirable. The spindle is so placed as to permit of end or side milling up to 8 inches deep.

The depth of cut is adjusted by the hand-wheel seen at top of the machine, which is connected by gearing with the cross shaft at the top, and this moves both elevating screws. The cross slide is 17½ inches wide in front, and 19 inches wide where it bears upon the uprights to which it is clamped both inside and outside. When desired, it is arranged to be moved vertically by power, and is so arranged that a vertical milling spindle, adjustable to any position, may be quickly attached or removed.

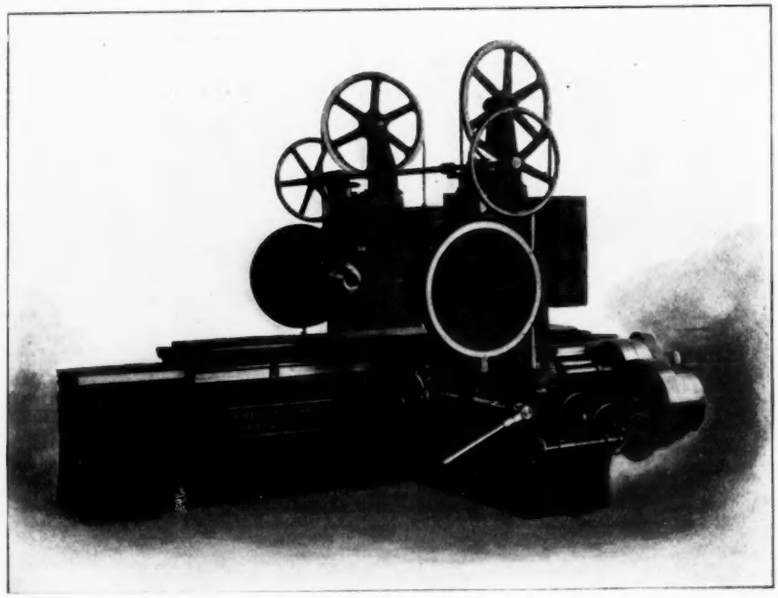
The well-known Sellers friction disks are employed for the feed motion, and these may be adjusted, while the machine is running, to give a feed varying from .04 to .36 of an inch per revolution of spindle, or from 1 inch to 8 inches per minute. They run at relatively high speed, and drive through the medium of worm gearing.

By a clutch mechanism, the arrangement of which is indicated by the engraving, the table can be given a power-return movement at three different rates, namely, 62, 36 and 24 feet per minute. It has an automatic stop motion, which disengages the feed at any desired point. The table can also be moved forward by power at the rate of 37 feet per minute.

The table has both a rapid and a fine adjustment by hand, the former by means of the large hand-wheel seen at the side of the machine, while the latter is obtained by means of the hand-crank seen at the top of the short vertical worm shaft, which is regularly driven by the friction disks previously referred to. The smaller hand-wheel is for adjustment of the rate of feed. The machine is supplied with an oil pump, and means are provided for taking care of the lubricant used on the cutters. It is 24½ inches between uprights; the platen is 22 inches wide, and the maximum hight from the table to the center of cutter mandrel is 24 inches. The machine is built to any desired length.

The second engraving is of a double machine having separate standards at each side, both of which are adjustable to or from the platen, and have an independent driving mechanism by which either one may be used separately, or they can be used together at the same or different speeds.

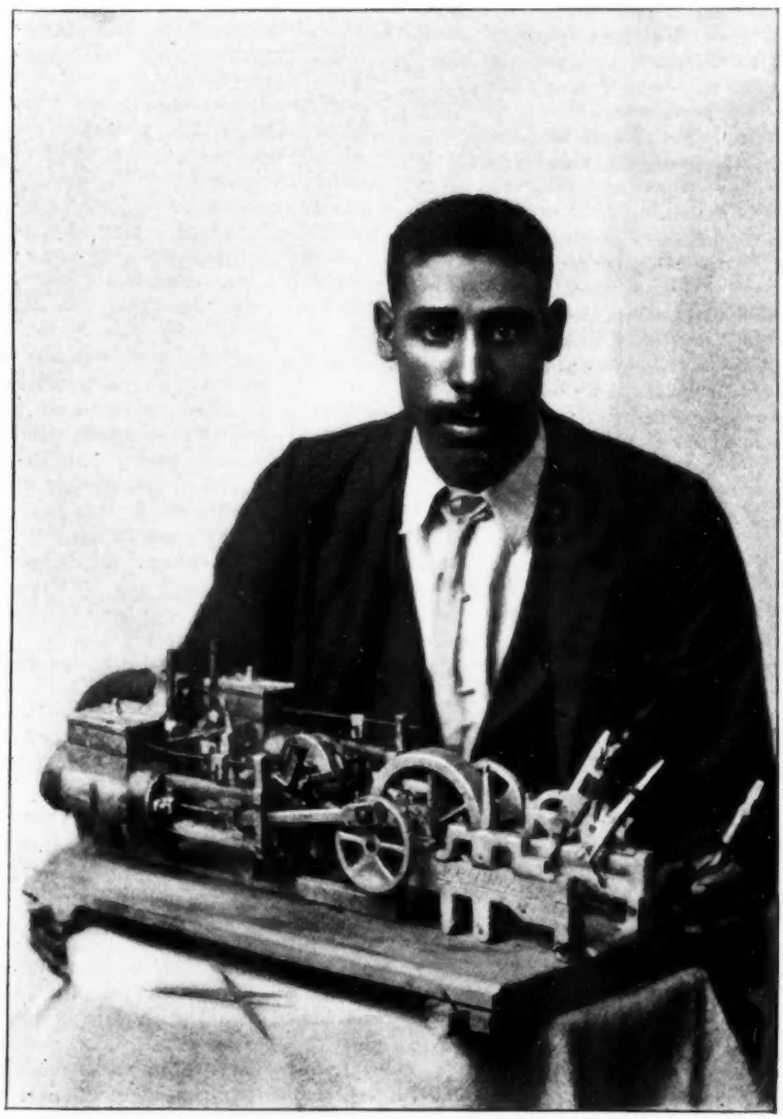
In respect to general proportions, driving power, etc., this machine is similar to the machine described above, the greatest distance between the uprights being 54 inches, and the least distance 24 inches. Spindles are 5 inches in diameter, and are supported in long bearings with adjustment for wear. The spindle saddles are counterbalanced, and are vertically adjustable by hand-wheels, either together or separately.



DOUBLE HORIZONTAL MILLING MACHINE.

Not only are the uprights arranged to approach to and recede from each other, but, when so ordered, the one on the off-side of the machine can be arranged to move back parallel with the table a suffi-

cient distance to make it entirely clear the other upright, and in this way end milling can be done on long work by one or both spindles, as may be required, or they may be used for milling two surfaces at the same time which are not opposite each other. The rate of feed is the same in this machine as in the one described above; the table has similar rapid and fine movements by hand and power, its power movement, however, being limited to one rate of 37 feet per minute in either direction. These machines are built by Bement, Miles & Co., Philadelphia, Pa.



AN ENGINE, ITS BUILDER AND HIS "EQUIPMENT."

▲ ▲ ▲

Letters from Practical Men.

A Feat in Engine Building.

Editor American Machinist:

Herewith you will find a photo of a piece of machinery which possesses enough of the curious, I think, to warrant its presentation to your readers.

Every mechanic, and many who are not mechanics, will recognize this as a steam engine, or rather, a pair of engines, having but one shaft and fly-wheel, and fitted with link-motion valve gear, somewhat after the style employed in a locomotive.

There is nothing in the general design of this engine, nor in any of its details, that will be of special value to anyone. On the other hand, those who may at first be disposed to criticise will doubtless be ready to concede to the builder and designer great credit, when they have learned how this machine was made, and by whom.

The first thing our young apprentices usually aspire to, outside of their regular work, is to build a small steam engine, and many produce very creditable work. The maker of the engine is a negro, and without any sort of mechanical training, he being employed as a valet, near the home of the writer. Furthermore, John, as he is called, managed to do this work without any shop facilities whatever, and the only tools employed from beginning to end were a pocket knife, two files, a pegging awl and a screw-driver.

I fear there are persons who may spring the question of veracity on me, when I say this; but all I have to say to them is, that should such a thing happen, I may as well give notice now, that in accordance with the code of honor, tomahawks and scalping knives for two will be in order.

Pardon me for the digression. It would make this letter too long were I to describe the many ingenious devices employed in doing this work; only a few of them can be mentioned. Nearly all the material used was babbitt metal, about 60 pounds of this being required. In order to avoid boring the cylinders, tin tubes were cast in them. The side pipes were formed by cores, composed of wire, cotton cord, sand and ashes. The pegging awl did service for a drill press in the soft babbitt, and ordinary wood screws tapped their own holes, and did duty in lieu of cap screws to hold on the cylinder heads and chest covers. And what is as remarkable as anything else connected with this work is, that the poor fellow did not even possess a vise.

As I said before, it behooves me to be a little guarded as to what I say, and what I don't say. I suppose, to melt the metal, John used an old pot belonging to his employer, General Warner, and perhaps a tack hammer, or hatchet. At all events, the work was accomplished at the General's country seat, and so quietly that it attracted little or no attention. The engine has stood the test of steam, and "fairly flies," as John expresses it.

There might be a first-class moral drawn from this, if we had the time, but I may say this, that it does not bespeak first-class skill, as I understand it, to hear men always complaining, and saying they cannot do this or that, because they have no tools.

I used to tell my men, when sending them to the country to do a job of work, "If you lack tools, make them out of a harrow, or fence rail, if there is nothing better at hand."

QUIRK.

▲ ▲ ▲

The Almond Engine.

Editor American Machinist:

I have been much interested in examining the Almond engine, as described and illustrated in your anniversary number. While there is so much that is original and very ingenious in the design of this engine, yet I cannot regard it as a great improvement on some other forms of rotary engine, and before offering any criticism, will say that your allusions to traditional prejudices against rotary engines have been carefully considered.

If I understand the valve arrangement, it consists of two disks having an automatic adjusting device; but I think sur-

faces of this kind have that rather serious objection of uneven wear.

Again, I think the unbalanced condition of the revolving cylinders caused by the protruding pistons at the upper side, will create a side strain on the shaft and unequal wear, and there seems to be no way of counteracting this.

As to the equilibrium formed by admitting steam under the shoes, it will be seen that the pressure thus produced is not nearly direct, longitudinally with the cylinder, except perhaps at one point near the mid-stroke of the piston. The effect of this side pressure must create a good deal of friction, especially at the beginning of the stroke.

The next and last defect which I see (but by no means the least) is the excessive condensation that may take place between the shoes and the outer case. It is clearly seen that so great a surface as that presented to these shoes cannot be kept very warm by the comparatively small contact of steam, and hence the loss referred to. If, however, these joints can be made practically steam and water tight, then these spaces will evidently be filled with water, which will serve the same purpose as that of steam, so far as balancing goes, and so this last objection may fall to the ground. But allowing that these pistons are well balanced lengthwise, the friction met with where the shoes bear against the case cannot be ignored, especially when the high velocity and centrifugal force exerted by these parts are considered.

I trust my criticism of this engine may not be regarded as too severe. The engine is certainly free from the objectionable features that are found in almost all other forms of rotary engines, and well deserves a place at the head of the list.

QUIRK.

Editor American Machinist:

In your big issue of November 4th I notice the Almond steam engine beautifully illustrated and described. I know Mr. Almond to be a genius, and that he has got up several good and useful mechanical contrivances. In fact, he is one of the successful inventors of this age. I think his engine is a good engine of the kind, and also that it ought not to be called a rotary engine. It seems to me to be a short-stroke, high-speed, reciprocating steam engine, which can be adapted to some special purposes where high rotative speed is essential. I suppose it will be capable of being nicely adjusted to run fast and smoothly; although I see no way of taking an indicator card from it to prove it. For this engine to run at 400 revolutions per minute will mean that steam has to be admitted and cut off at two-third stroke 1,600 times per minute. Cutting off at two-third stroke is not considered cutting off nowadays. [The engine may be built to cut off at any other point.—Ed.] Therefore it seems to me that the way to get economy out of the Almond engine is to build it in compound or triple-expansion forms. I have seen four cylinders going round a shaft placed eccentrically in their midst. I have seen the Brotherhood engine with its three single-acting pistons driving one crank, and I have seen the Colt disk engine with its six single-acting pistons pressing on a wabbling plate driving one crank; but I have never seen these engines take the place of our modern compound or triple-expansion engines, which have a piston speed of, say, 900 feet per minute. I believe in high-speed pistons, but also in giving steam time to expand—I don't care whether it be in a rotary or a reciprocating steam engine.

I wish it to be understood that I am not prejudiced against rotary steam engines. I have had considerable experience in that line, and claim that the day may come when locomotives and ships will be propelled by them. I have good reasons to believe that a compound or triple-expansion balanced rotary steam engine can be built to give as good results as we are now getting from reciprocating engines. I do not consider the rotary steam engine a forlorn hope yet; nor do I expect to be called on to put my notions into practice.

WM. K. AUSTIN.

Brooklyn, N. Y.

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A Bicycle Wheel for Wagons.

Editor American Machinist:

In the last number of the "American Machinist," in question and answer No. 151, we notice that J., Peoria, Ill., asks about wagon wheels on the same principle as the bicycle wheel. We think that the wheel which we are making comes very near to what he asks for, at least the load is suspended by the upper spokes. We have sold several hundred sets of these wheels in the past two years, and they are giving excellent satisfaction. We want you to know that there are such wheels in use.

THE ARNOLD METAL WHEEL CO.,
per D. J. C. Arnold.

New London, O.

[We give herewith a little sketch of this wheel, which seems to be quite an interesting invention, and not yet generally known. The wires are wound around the hub as a multiple helix, or there are as many wires wound side by side as there are spokes in one side of the wheel; each wire terminating in a tangent spoke at each end, or forming one spoke for each side of the wheel. Each two spokes are parallel to the same plane radially, although they, of course, all converge to the center of the rim. Thus in Fig. 2, *a a* belong to the same wire, and *b b* to another one. The helical wires being arranged like the threads of a multiple screw, the tangent spokes leave the hub at different points of the circle, but all at the same distance from or all close to the end of the hub, and divide the circle equally between them. The winding and entire shape of each wire is necessarily the same.—Ed.]

Fig. 1

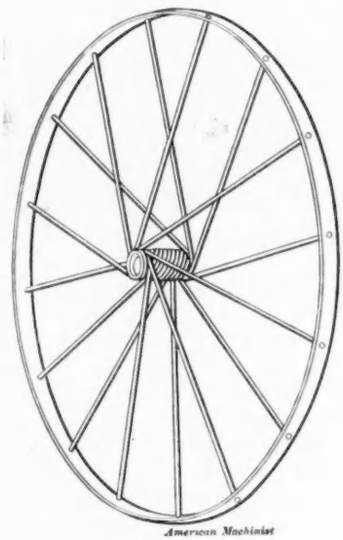

Fig. 2

BICYCLE WHEEL FOR WAGONS.

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"Pretty Near."

Editor American Machinist:

I suppose I have a rather pronounced habit of finding fault with things, especially if faults actually exist in them; but I rather think that this is pretty well offset by another habit of finding some good, or some excuse for saying a good word, for almost anything. A short time ago the "American Machinist" had something to say about "good enough." There is another of the same family that I have sometimes thought might also be deserving of a word of encouragement, and that is, "pretty near." For myself, I certainly believe there are some places where "pretty near" is really better than "just right." It may be because there is no such thing as "just right"; but that is getting down to too fine a point for me.

Of course, in these days they build lathes that do absolutely perfect work—turn straight, for instance—but I know by experience that it was not always so. It must be mighty inconvenient to have one of those perfect lathes. When I used to have to turn a shaft perfectly straight, I used to take a good deal of credit to myself when I succeeded, and blame the lathe when I failed. A perfect lathe would cheat me out of my rights.

I have not yet learned to believe in absolute precision in lathe work. We can

of course turn a cylindrical piece of unvarying diameter—if it is so short that we have no chance to measure the variation. I always had to stand over my work with calipers in hand, and to correct it constantly. Well, here I always found that " pretty near" was a pretty good friend. I always found it better, for my purposes, to have the centers pretty near in line with a known direction of variation, than to have them supposed to be absolutely correct. With the absolutely correct alignment of centers, I would have to adjust the tool both inwards and outwards, as it went along. I would be constantly getting the work now too large and then too small. I would have to feed the tool in a little at one point, and then to draw it back a little at another. Having to draw a tool back when it is cutting is a nuisance, on account of the slack of the thread. You can't draw it back by the actual pull of the screw without pulling it too far, or losing the cut entirely, if it is a light one. Some fellows have a way of slacking the screw a little and then rapping the tool holder back with the wrench. The tilting carriage is a good thing for this business, if nothing else can be said for it. Raising the tool by the back screw has practically the same effect as drawing the tool back, and the slack makes no trouble. The change of hight is generally not enough to affect the cutting or clearance angles of the tool. To feed the tool in, it may be lowered or it may be fed in horizontally, and if there is much adjusting as the cut goes along a judicious use of one or the other of these will enable a fellow to keep the angular adjustment of the tool pretty near what it should be. But not having the tilting rest, I always found it best to have the lathe centers out of alignment enough so that I would know I had to constantly feed the tool in if any change was needed, and not both in and out, sometimes one and sometimes the other. When it comes to boring in the chuck, probably the majority of lathemen believe in the "pretty near" idea to the extent of preferring that the lathe should bore slightly larger at the outside.

The preference for "pretty near" in lathe and other machine work is, of course, after all only an acknowledgement that there is no such thing as absolute parallelism possible for the work of a single cutting tool. If a cut could be started and set exactly to size, and if it could then be left to itself until the cut was finished, with perfect confidence that it would be all right, that would be better than "pretty near" can do for us; but who knows where work can be done that way?

"Pretty near" has even a better claim to consideration than in lathe adjustment when we come to balancing work. We all know something about balancing—that is, standing balance; we don't any of us know as well about running balance. We all of us, at some time or another, probably, have had to balance a pulley or a fly-wheel, or something of that sort. We have our pulley on the shaft or mandrel with nice, true ends. Then we get a couple of good heavy parallel pieces from the big planer, and proceed to level them up with the greatest care. Well, the greatest care is the greatest nonsense. For a balancing job it is not only not necessary to have the bars absolutely level, but it is decidedly better to have them "pretty near," instead. This should not require very much argument. You set the shaft on the parallel bars, and the pulley soon shows you where the heavy side of it is. You stick a chunk of putty on the light side, turn the pulley a quarter of a turn, let go of it, and you know at once whether the putty is heavy enough or not. By this familiar process the pulley may soon be brought to stand still on the dead-level parallel bars, no matter which way it is turned. If it is perfectly balanced, there will of course be no reason for it to move either one way or the other. It would require some inclination of the bars to induce it to roll by gravity. Supposing the bars to have a slight inclination, a careful man might then find that the pulley would start from rest and roll downhill if one point of its circumference was upward; while if the opposite side was up, it would not start to roll, or it would start slower. This would indicate that the pulley was still slightly out of balance, and it might be corrected, so that it would start to roll with equal promptness, no matter which side was up, and this would indicate a more perfect standing balance than had been secured with the dead-level bars. I am not sure that it would not be good practice, where much of this balancing was to be done, to have some dead-level parallel bars for the preliminary balancing and some "pretty near" level for the final fine adjustment. I might say more, but this letter is "pretty near" too long for the subject.

TECUMSEH SWIFT.

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A Hole That Closes by Wear.

Editor American Machinist:

As something of a freak in mechanics, I would mention the case of a hole growing smaller by wear; and this is the way of it:

We have an engine in which the piston and valve rods are packed by being fitted to run steam-tight, or nearly so, through solid babbitt sleeves or bushings, and, contrary to all expectations, these packings, instead of soon wearing to an objectionable leak, really close up, so that they must be reamed out from time to time.

The piston-rod bush is 6 inches long and about 5-16 inch in thickness, and held by a ball and socket joint near its center. The rod is 1¼ inches diameter, and runs 500 feet per minute. This bush began closing up so as to be noticeable after it had been in use about six weeks, and required scraping out at irregular intervals of from three weeks to two months during more than four years of use, when it failed by leaking through the ball joint. The extra bushing sent with the engine was then put in use. It has been in about a year, and while it closes up, yet it does not require half the scraping the first one did; but as it can be removed, scraped and replaced (if taken while very hot) in half an hour, I am highly pleased with it as a packing for this place.

The valve-rod packing is a bush or sleeve 11¾ inches long, about 5-16 inch in thickness, and is held by clamping a collar near its exposed end with a collar nut against flat surfaces. This packing will run several months without attention, but must be taken out and reamed within two days of its first symptons of sticking.

I noticed its beginning to stick one Thursday, but thought it would go until Saturday, and it did—but with the result of pulling the head off the bush, and necessitating splitting the body with a parting tool in the planer before it could be removed from the rod.

We now have in this place a brass body bush lined with babbitt; this works better, but still shuts up. The babbitt has closed enough now to be leaky in the brass; but I have stopped that by soldering it at both ends. Even with all the above, it is less trouble than soft packing, and as nearly as I can learn, this is an isolated case.

I should think enough metal has been scraped out of the piston-rod bush to have enlarged its bore 1-64 inch, had it all been removed at once.

As an instance of the "unexpected which sometimes happens," I mention it, leaving the solution of its cause with yourself and readers.

CHARLES S. BEACH.

Bennington, Vt.

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Magnetized Tools.

Editor American Machinist:

Why don't the makers of taps magnetize them, so that they will remove the chips when they are backed out of a hole? Why don't they magnetize their twist drills, instead of expecting a man to ruin his eyes blowing out the chips with a piece of gas pipe, or trying to fish them out with a piece of wire? Why don't the man doing the fishing magnetize the wire? Surely he could do better fishing.

B. C. N.

Hamilton, O.

[Such tools sometimes become accidentally magnetized, and when in that condition are generally regarded as nuisances, for they must be always being cleaned, and are yet never clean.—Ed.]

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Fred J. Miller, Chief.

Frank Richards, F. A. Halsey, Edward P. Buffet, } Associate Editors.

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Illustration Department.

A. L. Donnell, Chief.

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Advertising Department.

C. P. Day, Eastern Representative.

J. M. Wakeman, Western Representative.

▲ ▲ ▲

British Representative.

R. E. Howard, 9 Leonard St., Finsbury, London, E. C.

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Space in advertising pages only is for sale.
We invite correspondence on subjects pertaining to machinery.
Name and address must always be given, though not necessarily published.
Communications for or relating to the reading columns should be addressed to the Editor. All business communications should be addressed to the Company.
Subscribers can have their mailing address changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.

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SUBSCRIPTION PRICE:

$3.00 a year in advance, postage prepaid in the United States, Canada and Mexico.

$4.00 a year to other countries, postage prepaid.

Entered at Post Office, New York, as second-class mail matter.

For Sale by Newsdealers, Everywhere.

No back numbers beyond 1896.

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Inquiries for Machinery.

Experience having shown us that we are unable, in some cases, to otherwise obtain full information regarding the manufacturers of certain machines, we commence elsewhere in this issue the publication of some of the inquiries we receive. In some cases we know of no makers of machines asked for, and have to ascertain by correspondence. In other cases we may know one or more builders, but not all builders, of a machine asked for. We do not expect this new department to take the place of our present "Information Bureau," but it will be supplementary to it, and will assist in making it more efficient. We hope this department of inquiries will be made use of by all our readers. It will be to the interest, not only of individuals, but of the machinery trade generally, that this should place all inquirers in correspondence with those who regularly build, or will contract to build, the required machines.

Many of these inquiries come from abroad; but, no matter where they come from, they will in every case, so far as we can judge, mean business, and will be worthy of attention.

Each inquiry will be numbered serially, and in referring to them the numbers should be mentioned, as that is our only means of identification. We make no charge for this service, but will be glad to have anyone who chooses make use of the department, either as an inquirer or as a manufacturer.

Addresses of inquirers will be furnished on application. We cannot undertake to forward catalogs.

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Getting Enough to Do.

If we are going to do much, we must first of all have it to do. We all know as much as that; but we do not, perhaps, all realize how the ability to do depends upon the doing. The conditions for successful and most efficient work seem to be quite similar for either tools or their users. If we have not enough to do, or if we are not allowed to do enough, we cannot usually do best even what we do. This matter has been coming before our readers of late in rather curious shape, and all may not have realized the full scope and application of the principle, or the sharpness with which it has quite recently been brought out. Mr. Tecumseh Swift calls attention to it in a recent letter, but he seems to stop considerably short of showing the full reach of the case.

It begins, as far as recent developments are concerned, with taps. It seems to be quite clear that we have not been giving them, or their individual teeth, enough to do, and time and taps have been wasted. The same seems to be true of milling cutters also. Their efficiency is increased by giving each tooth more to do. This does not mean merely that more cutting is done in direct proportion to the increase of feed, but that each cutting tooth, as an agent between power applied and work accomplished, has more of the latter to show for any measured consumption of the former. The increased efficiency is realized both in the economy of power and in the endurance of the tool. The record for either is greatly in favor of hard work, rather than of easy work. Indeed, it may be said that the easy work is really the hard work. It would be proper to infer that the efficiency of the cutting tool, both as to the economical use of power and as to the slowness of wear, would be found at its highest in that lathe, recently mentioned in our columns, which made its chips at the rate of a ton an hour.

The efficiency of cutting tools has been a progressive revelation. Prejudice and cowardice have given way slowly before it. The same obstacles have been as fatal to efficiency with worm gearing. We have all along been afraid of steep pitches for worms, and only lately we are generally finding out by extended practice, and by unexpected experiences under compulsory conditions, that the steeper pitch or the harder work for the worm means there also increased efficiency. While we have been snailing along with worm angles of ten degrees or so, we find now, upon cool investigation, that much higher efficiencies reside in the forties and fifties.

Then there is the same story with the steam engine. All the way along in the course of its development, that development has consisted almost entirely in piling more work upon it. We have today the most efficient steam engine ever known, because it works the hardest. Higher speeds and higher pressures are savers of coal and water.

It cannot be different with men. Efficiency is nowhere more to be prized than in the direct results of human effort, and efficiency of mind or muscle is secured under the same conditions as with other media of accomplishment. It is no kindness to give the normal man little to do, and the man who turns out best in the end is usually he who is given, or who gives himself, enough to do, so that he need never slacken his pace for fear of "running out of work."

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Navy Personnel.

Seven line and three engineer officers, composing a board appointed some time ago to consider the personnel of the navy corps, have, it seems, given their approval of some such plan as that we referred to last week. Its adoption is certainly much desired, if nothing better can be adopted, and inasmuch as this plan will eventually make all naval officers engineers and all engineer officers also line officers, it will inevitably do away with the prime cause of the present difficulties. Whether it will eventually cause new difficulties to be in their turn overcome, is a question which time only can answer.

We cannot persuade ourselves that as good engineer officers can be developed in this way as could be developed under a plan which would enable engineers to devote their attention solely to engineering and to have authority, rank and title commensurate with the importance of their duties in modern naval practice.

We believe that one result of the proposed plan will be that the real management of machinery on naval vessels will eventually be in the hands of petty officers who are machinists and skilled enginemen. Will good first-class men of that kind be attracted to and retained in a service which is permeated with the most intensely aristocratic notions, and in which there will be absolutely no hope of rising above a grade in which they can have no authority commensurate with their actual responsibilities? For it is to be remembered that although non-commissioned officers and privates in the army can hope for commissions and look

forward to wearing shoulder straps, no volunteer in the navy, no matter how well qualified he may be, can hope for any such rewards for faithful service or for honest or heroic endeavor in his country's service.

It is, of course, evident to all who are not utterly blinded by prejudice that something must be done to better present conditions. While the step now proposed to be taken may be in the right direction, we predict that other steps must follow it before our navy will be placed upon a basis in accordance with present-day conditions. At present it is hide-bound and moss-backed.

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Inquiries for Machinery.

Those who make, or who may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiries as follows:

1. From Germany for duplex milling machines for grooving twist drills up .8 inch diameter "from the long rod."

2. For machinery for making beet sugar, and for the address of parties who make a business of erecting such machinery.

3. For machines for making wagon or lag screws with square and hexagon heads and gimlet-pointed threads, the screws to be from 5-16 to ⅝ inch diameter.

4. For makers of traction engines, suitable for drawing wagons on common roads, for hauling clay.

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Fall Meeting of the A. S. M. E.

The program for the eighteenth annual meeting of the American Society of Mechanical Engineers has been issued.

The sessions will begin at the society's house, 13 West Thirty-first street, New York, at 9 P. M., Tuesday, November 30th, at which time President Worcester R. Warner will deliver his annual address. His subject will be, "The Evolution of the Telescope."

Professional papers to be presented during the sessions will be as follows:

Wednesday morning, 10 o'clock:

Christie, W. W.—"Boiler Tests; Classification of Data and Plotted Results."

Dean, F. W.—"Reduction of Cost of Steam Power from 1870 to 1897."

Thursday morning:

Carpenter, R. C.—"Tests of Centrifugal Pump and Calibration of Weir at the Bridgeport Pumping Station, Chicago."

Stillman, Howard.—"A Water Purifying Plant."

Thurston, R. H.—"Multiple Cylinder Engines; Effects of Variation of Proportions and Variable Loads."

Aldrich, W. S.—"Notes on Rating Electric Power Plants on the Heat-unit Standard."

Keep, Wm. S.—"Cast Iron Under Impact."

Thursday evening, 8:30:

Mayo, Jno. B.—"A Strength of Gear Chart."

Guelbaum, David.—"A Law of Hydraulic Obstruction of Flow in Pipes."

Richmond, George.—"Thermodynamics Without the Calculus."

Norris, H. M.—"An Accurate Cost-keeping System."

Main, Chas. T.—"The Valuation of Textile Manufacturing Property."

Smith-Whaley, W. B.—"Electricity in Cotton Mills."

Hartness, Jas.—"Screw-die for the Turret Lathe."

Hartness, Jas.—"Staybolt Threading Device."

Friday morning, 10:30:

Rice, A. L.—"Convenient Form of Wire Testing Machine."

Woodbury, C. J. H.—"Dustless Buildings."

Fletcher, Andrew. — "The Stevens Valve-gear for Marine Engines."

Dickie, Geo. W.—"Auxiliary Engines and Transmission of Power on Naval Vessels."

Bissell, Geo. W.—"A Boiler Setting."

Mumford, E. H.—"Machine Molding Without Stripping Plates."

The principal social function will be, as usual, Wednesday evening, at Sherry's, and the afternoons will be left without special exercises.

Niagara Falls is being considered as the place of meeting for next spring.

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Society of Naval Architects and Marine Engineers.

The fifth annual meeting of the above-named society took place last week in the house of the A. S. M. E. at 13 West Thirty-first street, New York, commencing on the 11th. There was a good attendance, and one of the visitors was A. F. Yarrow, the English torpedo-boat builder. The subject of "Water-tight Bulkhead Doors" was presented in a paper by W. B. Cowles. Lewis Nixon read a paper on "The Regulations for Loading Vessels." H. G. Gillmor, U. S. N., read a paper on "Torpedo-boat Design," which included the presentation of two designs, and this paper was discussed by Mr. Yarrow. Professor W. F. Durand, of Cornell University, read a paper entitled "An Experimental Study of the Influence of Surface on the Performance of Screw Propellers." Professor Cecil H. Peabody submitted a paper on "Progressive Speed Trials of the Boston Police Boat Guardian." A paper by C. E. Wheeler, "The Commerce of the Great Lakes," was placed on file, as Mr. Wheeler was unable to be present. Other papers presented were as follows: By Chief Naval Constructor Philip Hichborn, "Some Notes on the Speed Trials and Experience in Commission of Our New Battleships." It discussed the trial trips of the four new first-class battleships, Iowa, Indiana, Massachusetts and Oregon. "The Use of Water Ballast for Colliers in the Pacific Coast Trade," by F. B. King; "The Estimated Weights of Machinery," by Professor George R. McDermott; "Navy-Yard Expenses," by W. J. Baxter, and "The Pneumatic Steering Gear of the United States Steamship Terror."

The following officers were elected: President, Clement A. Griscom; vice-presidents, F. M. Bunce, Charles H. Cramp, Philip Hichborn, Charles H. Loring, T. W. Hyde, William H. Webb, George W. Melville, George W. Quintard, Irving M. Scott, E. A. Stevens, Frank L. Fernald; members and associate members of the council, Francis T. Bowles, French E. Chadwick, Washington L. Capps, James E. Denton, William F. Durand, Edward Farmer, H. T. Ganse, Nathaniel G. Herreshoff, William H. Jacques, John C. Kafer, Frank B. King, Frank E. Kirby, W. M. McFarland, Jacob W. Muller, Lewis Nixon, John F. Pankhurst, C. H. Peabody, Herrington Putnam, William T. Sampson, Horace See, E. Platt Stratton, Stevenson Taylor and George E. Weed.

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Charles Roberts, president of the South Chester Manufacturing Company, and Charles A. Weed, president of the Tidewater Steel Works, were killed November 10th by a train on the Philadelphia, Wilmington & Baltimore Railroad near Lamokin, Pa. Mr. Roberts was 60 years old; Mr. Weed 65.

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Commercial Review.

NEW YORK, Saturday Evening, Nov. 13.

THE ENGINE MARKET.

The season's business in steam-power machinery makes a fair showing. Reports of the degree of activity of some of the larger works are encouraging. It is not unlikely that the market, upon the whole, is much better than the complainings of some of the local agencies would imply, and even among these there are instances of rushing business.

The Edward P. Allis Company has been phenomenally fortunate this year in the number of big European contracts which have reached it. Among the more recent were orders from Middlesboro', England, for three engines of 600 or 700 horse-power each, and from Trieste, Austria, for two still larger ones. The latter are for use in an iron works, and weigh 500 or 600 tons apiece.

The Pierce & Miller Engineering Company inform us that they are very busy, both at home and abroad, and can hardly send out their estimates fast enough.

A firm of prominent Western engine builders, whom we are not at liberty to

mention by name, are very busy, and have been so for a long time. During the middle of this fall they have been rather relieved because a little slackening of orders is giving them a chance to execute those that they already have on hand. The lull in trade alluded to was a circumstance which was quite widely felt among the engine and other machinery sellers last month. It might have been owing to the election or to the advancing season, or to the termination of the placing of those new orders which were waiting upon the passage of the tariff bill. Some of the inquiries which have come to the local office of the concern alluded to within the last three or four days are for an 1,100, a 750, two 450 and two 500 horse-power engines, for the home and foreign markets. There is also on hand an inquiry for four or five 2,500 horse-power engines for electric lighting purposes in this country. This line and that of street railway work furnish the field for a large proportion of their orders. They have shipped, this week, four engines to Buenos Ayres.

The Weston Engine Company may be mentioned among the busy ones.

In the Claus Spreckels sugar refinery, of San José, Cal., a large plant of Russell engines is to be installed. There will be some twenty or more in all, aggregating 6,800 horse-power.

The Baldwin Locomotive Works, of Philadelphia, have booked orders for fifty-six locomotives within a few days past. They have recently received contracts, also, for fifty-eight locomotives to be shipped to foreign countries.

ENGINES FOR NEW YORK BUILDINGS.

Among important buildings in this city for which contracts for engines have been placed this season are the Washington Life Insurance, the Singer, the New York Athletic Club, the Empire and the new Mills Hotel. The Mills office building has added to its engine equipment. The Franklin Building, just around the

(*Continued on page 35.*)

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Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Brass ptrn. letters and figs., for sweatg. on metal trns. Knight & Son, Seneca Falls, N. Y., Box 12.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy shou'd be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

M'ch eng, 2 yrs exp, pos as dft'n. Box 75, Am Mach.

Situation wanted by exp. mechanical draftsman; technical graduate. Box 74, American Machinist.

Mech. eng., graduated in Germany, age 26, wants position; spec. and gen. mchy. Box 81, Am. Mach.

Draftsman and des. wishes a situation; folding mchs and gen. mchy. Address Box 89, Am. Mach.

Hot blast heating engr wants engagement; technical education. "Practical," Box 88, Am. Mach.

If you need a capable mech'l engineer and draftsman with wide experience and technical education, address Box 79, American Machinist.

Mechanical engineer, with extensive experience as superintendent and manager of large machine works, is open to engagement. Stationary and marine engines, boilers, foundry work, gearing and general machinery. Can manage shops, engineering department, estimate or solicit. Best of references. Address Box 82, American Machinist.

Help Wanted.

Wanted—Traveling salesman, one who has had exp. in selling cranes preferred. Box 80, Am. Mach.

Wanted—Two A1 mechanical draftsmen; exp. on small tools or instruments preferred; state age, experience and salary. Address Box 90, Am. Mach.

Wanted—Foreman for shop tapping iron pipe fittings, valves, etc.; must be good mechanic and capable of handling men; refs. Box 67, Am. Mach.

Wanted—Foreman for machine shop; one that has had experience on marine work preferred. State age and salary expected. Address Phoenix Iron Works, Port Huron, Mich.

Foreman wanted for shop who has practical knowledge of architectural work, engine work, repairs and general machinery. Must be up to date. Address Atlanta Machine Works, Atlanta, Ga.

Compet't man to take charge of marble shop. One acq. with mchy and convrs. with making plumbers and furniture slabs. Ad., with full particulars, "Manufacturer," care W. H., 874 Broadway, New York.

We want steady, industrious and ambitious foreman for our new mch shop. Work mostly repairs. Must be capable of soliciting work and making estimates. Dickson Car Wheel Co., Houston, Texas.

Wanted—A first-class salesman who is thoroughly familiar with punching presses and rolling mills; first-class refs. Send photo. with particulars to Mossberg & Granville Mfg. Co., Providence, R. I.

Wanted—A salesman having a good trade among factories, machine shops and engineers in N. Y. City and vicinity. Only those having established trade need apply. Communications strictly confidential and a good paying position is open to the right man. Box 84, American Machinist.

Wanted—Strictly first class working foreman for forge shop located in Eastern Massachusetts. Must thoroughly understand hammer die forging and setting up dies for same, also hardening, case hardening, annealing, etc., in all of its branches. No person will be considered for this position unless he can show good references where he has had charge and is strictly first class in all branches named. Box 86, American Machinist.

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Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S. M. York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Dies & Die Mak'g, $1. J. L. Lucas, Providence, R I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Machinery to order, inventions developed. Leland, 469 Van Buren Street, Brooklyn, N. Y.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

Wanted—To manufr. for respons. parties sheet metal stampgs., ptns., models, dies for metal, leather, cloth or paper. Bell Elec. Co., 46 E. 14th St., New York.

Model Locomotives—Complete castings, latest N. Y. Cen. standard, up to date; 4c. in stamps for cat. alog. G. H. Olney, 163 Herkimer St., Brooklyn, N.Y.

Wanted—By responsible firm, the New York agency for a first class gas engine. Have best of facilities and large acquaintance in this section. Box 83, American Machinist.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

Wanted—Agency for N. Y. City for full line of steam engines and boilers by responsible house. Have fine store for showing goods and practical men at the head of it. Address Box 85, Am. Mach.

Small Manufacturers Wanted—The business men's association of one of best cities in middle West solicits correspondence with parties seeking new location for mfg. enterprises. "Business," Am. Mach.

Wanted—Manufacturers of small and medium sized machine tools of the most modern design to send catalogs and prices in view to the intended extension of an estab. business; no agents at pres.; early response requested. Ad. Box 87, Am. Mach.

For Sale—One engine lathe, 20" swing by 8' bed, G. A. Gray make, $170; 1 lathe, 14" swing by 6' bed, Lodge & Davis make, $100; 1 horizontal boring mill, bores from 4" to 20" cylinder, Barrett Vise & Tool Co. makers; 1 extra heavy vertical boring mill, has 3 separate cutter bars, each has independent automatic feed, weight 15,000 pounds, price $600. Box 91, American Machinist.

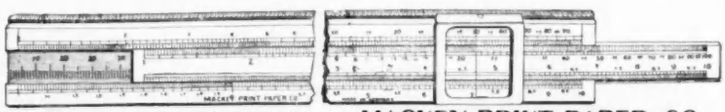
THE CROSS OIL FILTER

actually reduces oil bills 50% or more. Sent on approval. Used in 14 countries. Testimonials from leading firms in every field of industry.

Business established seven years

THE BURT MFG. CO.
AKRON, O., U. S. A.
Largest Manufacturers of Oil Filters in the World.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treasurer.



Polished Boxwood or Celluloid-Faced Calculating Rules. Tavernier, Gravet and Manheim Systems.
A Full line of Engineers', Mathematical and Architects' Instruments, Materials and Supplies.

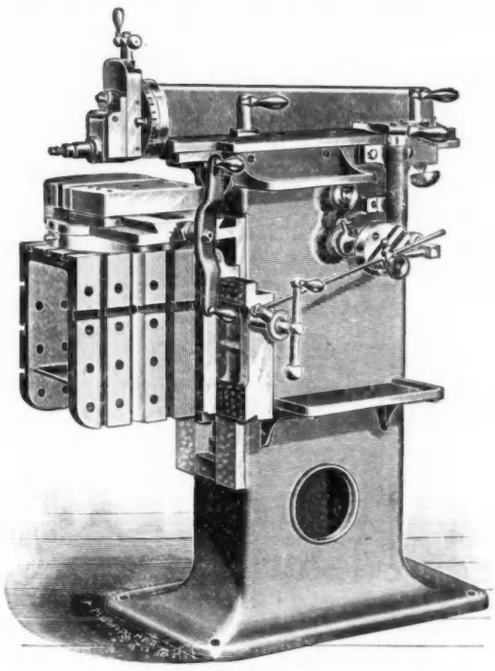
MACKEY PRINT PAPER CO.
Importers and Manufacturers,
PITTSBURGH, PA.
A fully illustrated catalogue to Professionals on application.

A Commutator Necessity. Ask your supply house or the manufacturer for free sample stick . .

50 cts. per stick. $5.00 per dozen.

The only article that will **prevent sparking.** Will keep the Commutator in good condition, and **prevent cutting.** Absolutely will not gum the brushes.

K. McLENNAN & CO., Sole Mfrs., 1128 Marquette Building, Chicago, Ill.



..IMPROVED..

15-inch Hendey Shaper.

Latest Improvements.
Useful Attachments.
Strong and Powerful.

...FOR...

Die Work, Tool Room or General Shop Work.

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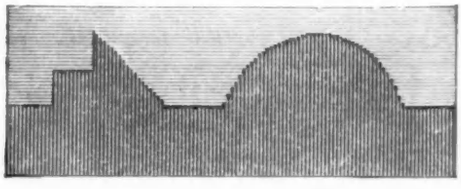
The stroke can be adjusted for curves with machine in motion. The stroke can be adjusted for angles with machine in motion. The stroke can be adjusted for irregular work with machine in motion. It has adjustable table for planing taper work; table can be removed for fastening work to apron. Has a strong graduated swivel vise. Quick work, rapid changes, modern ideas.



This cut shows how stroke can be adjusted with machine in motion by micrometer; adjustment fine and delicate. SEND FOR CIRCULAR.

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THE HENDEY MACHINE CO.

TORRINGTON, CONN.

Agents for the Pacific Coast—PACIFIC TOOL AND SUPPLY COMPANY, San Francisco, Cal.

European Agents,
SCHUCHARDT & SCHUTTE, Berlin, Vienna, Brussels, Stockholm.
CHAS. CHURCHILL & CO., Ltd., London, and Birmingham, Eng.
ADPHE. JANSSENS, Paris, France.
EUGEN SOLLER, Basel, Switzerland.

(Continued from page 34.)

corner from the office of the "American Machinist," is another of those ordering plants, and its feature of interest is that it will let out lofts furnished with electric power. This is a species of enterprise which, before long, will no doubt become very general.

IN THE MINING LINE.

Last year the Calumet & Hecla Copper Mining Company installed three 18 × 24-inch double-cylinder mining engines, built by the Lidgerwood Manufacturing Company, for hoisting from a depth of 4,000 feet. An order for a fourth engine has just been placed. The Lidgerwood Company once built an engine for hoisting on a vertical incline 2½ miles; but never before to hoist vertically from such an extraordinary depth as 4,000 feet. The Calumet & Hecla mining plant is said to be the finest in the world. For export, the Lidgerwood Company are building a mining engine for a large mine in Norway, and for general purposes have recently received orders from London for seventeen engines of various sizes. It is encouraging to note that the number of engines ordered of them this week outdoes that of last week by two or three times over.

A certain exporter to South Africa claims that shipments of mining machinery will be much heavier in the next six weeks than in the past three months.

Some large mining machinery contracts for Mexican enterprises are expected to be closed by another concern before the end of this year.

NOTES ON BOILERS.

The largest boiler company in this market is said to be busy.

The Heine Boiler Company, of St. Louis, is experiencing very much improved conditions. The beauty of it is, that while some time ago there was plenty of work talked about, but few actual sales, now people are actually placing orders. The company is erecting 1,500 horsepower of boilers in the Chester jute mills, at Greenpoint, Brooklyn, the special feature of which installation is that the boiler room is only 48 feet wide, and this make of boilers claims peculiar adaptability in that they can be set in a solid compact battery, in such a space, without passageways between them.

The Abendroth & Root Manufacturing Company have been shipping boilers to Venezuela, the United States of Colombia and Mexico. Three more orders for boilers to go to the last named country are now on hand. They are very busy with contracts for spiral riveted pipe, while in boilers there is a temporary lull experienced in the home market.

Quotations.

NEW YORK, Monday, November 15.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 75 @ $12 00
No. 2 foundry, Northern	11 25 @ 11 50
No. 2 plain, Northern	10 75 @ 11 00

Gray forge, Northern.....$10 25 @$10 50
No. 1 foundry, Southern..... 11 00 @ 11 25
No. 2 foundry, Southern..... 10 50 @ 10 75
No. 3 foundry, Southern..... 10 25 @ 10 50
No. 1 soft, Southern..... 11 00 @ 11 25
No. 2 soft, Southern..... 10 75 @ 11 00

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 1.50 @ 1.60c.

Cold Rolled Steel Shafting—Base sizes, from store, in small lots, 2.40 @ 2.50c.

Copper—Carload lots, Lake Superior ingot, 10¾c.; electrolytic, 10½ @ 10⅝c.; casting copper, 10⅜ @ 10½c. for ordinary brands.

Pig Lead—Carload lots, 3.75 @ 3.80c., f. o. b., New York.

Pig Tin—For 5 and 10-ton lots, 13.75c., f. o. b.

Spelter — Carload lots, 4.05 @ 4.10c., New York delivery.

Antimony—About 7¾c. and upwards for Cookson's; 7⅜c. and up for Hallett's; 7c. and up for Japanese.

Lard Oil—A good commercial brand of prime city, ice pressed, is quoted at 40c. wholesale; ordinary present make, 2 @ 3c. less.

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Manufactures.

At Erie, Pa., the tannery of J. C. Kurtis has been destroyed by fire.

Daily & Carlson are to erect on Wooster street, this city, an eight-story factory.

The Jackson Corset Company, of Jackson, Mich., is to erect a new factory building.

The Lake Shore Foundry Company, of Cleveland, O., contemplates building a new foundry.

The Jessup Foundry & Machine Manufacturing Company, of Jessup, Ga., is to erect a foundry.

The Atlanta Tin-Plate Company, of Noblesville, Ind., is to double the capacity of the plant.

The Eaton, May & Robbins Paper Company, of Lee, Mass., will enlarge and otherwise improve its plant.

Bridges & Henderson are building their cement mill at Hancock, Ind., recently destroyed by fire.

The Union Knitting Mill, Hudson, N. Y., was recently destroyed by fire, the loss amounting to about $100,000.

The Ohio Brass & Iron Manufacturing Company, of Cleveland, O., will erect a new building, to cost $7,000.

The grain elevator of Yost Bros., at Macon, Ill., has been destroyed by fire. The loss is estimated at $15,000.

The Diamond Stamped Ware Company, of Detroit, Mich., has been incorporated, with a capital stock of $50,000.

The Manville Bros.' Company has been organized at Waterbury, Conn., to buy and sell machines and machinery.

The Standard Manufacturing Company, of Hartford, Conn., has leased the basement of the E. E. Brown machine shop.

William F. Read, of Philadelphia, is to erect an addition to his plant at the corner of Jackson and Isomniger streets, that city.

The Cleveland Machine Screw Company, Cleveland, O., will immediately begin the erection of an addition to its factory.

The Champion Iron Fence Company, of Kenton, O., has been incorporated. The office will be located in Jefferson City, Mo.

The American Glucose Company, which recently secured control of the Waukegan (Ill.) Sugar Refinery, will enlarge that plant.

The Sackville (N. B.) Foundry & Machine Company is erecting additions to its plant, and new machine tools will be installed.

The Leonhardt Manufacturing Company, of

(*Continued on page 37*)

HOLDERS WITH INSERTED CUTTERS,

For turning, cutting off, threading, shaping and boring metals. The cutters are inexpensive and may be sharpened by grinding, without changing the form.

MILLING CUTTERS, in variety, carried in stock and made to order. Punches and Dies for plate work. Taps, Dies, Reamers, Gauges.

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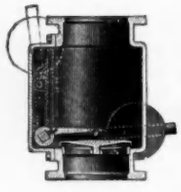

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This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments

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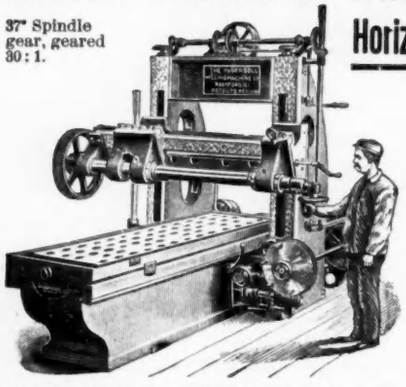

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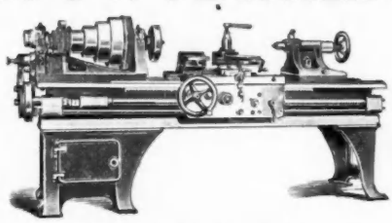

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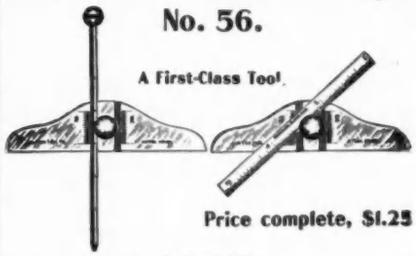

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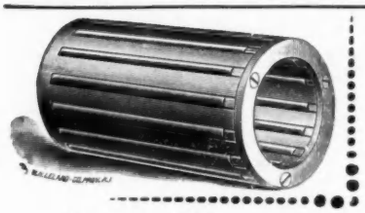

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We will guarantee a total absence of heating from friction, and a saving of from 25 % to 75% of the power previously used. Inquiries are in order.

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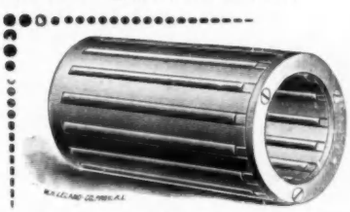

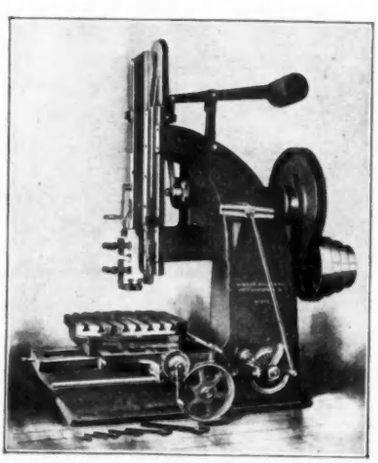

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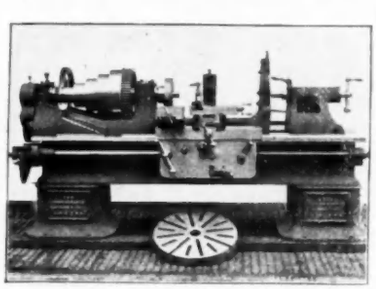

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Taper Attachment Set or Released Instantly. : : : :

The Lodge & Shipley Machine Tool Co.,

CINCINNATI, O., U. S. A.

(*Continued from page 30.*)

Baltimore, Md., has been organized, and a factory 25 x 161 feet will be erected by it.

The wooden portion of the Lukens Iron & Steel Works, at Coatesville, Pa., which was recently destroyed by fire, is to be rebuilt of iron.

The Pennsburg Manufacturing Company, Pennsburg, Pa., is about to rebuild the planing mill recently burned. It will be 60 x 100 feet.

The city of Hannibal, Mo., has ordered from the Murray Iron Works Company, of Burlington, Ia., a Sioux Corliss engine of 450 horsepower.

The Kelly & Jones Company, of Greensburg, Pa., have opened an office at 29 New Bridge street, London, England. Mr. Joseph A. Kelly will be in charge.

Love Bros., owners of the Indiana Cotton Mill at Indianapolis, are to erect an addition to their mill. This will be 135 x 100 feet and four stories high.

Improvements are to be made to the Caldwell & Peterson manufacturing plant at Wheeling, W. Va. A new building, 230 x 67 feet, is to be added.

Chadbourne & Moore, Chelsea, Mass., intend to erect a building, 75 x 46 feet, two stories, at the corner of Cypress and Beech streets, to be used as a manufactory.

The Western Malleable Iron & Foundry Company, of Milwaukee, Wis., lately of Port Washington, is to erect new buildings, comprising foundry and machine shop.

C. C. McNutt and others recently leased a part of the Warren (O.) Machine Works plant, and will establish a third electric lamp factory in that city, to employ 100 persons.

The Oriental Manufacturing & Knitting Company, of Philadelphia, Pa., is to erect an addition to its plant. This addition will be 40 x 130 feet, and three stories in hight.

The Nasonville Woolen Company has been incorporated, and will erect a building at Burrillville, R. I. The incorporators are Eli Gilboa, W. H. Gilbert and William M. Lacy.

Contractors Stacy Reeves & Sons are estimating for a one-story stone extension, 62 x 189 feet, to the steel foundry of the Standard Steel Works at Burnham, Pa., near Lewistown.

The Standard Steam Specialty Company, of New York City, has been incorporated. The following are directors: Herbert A. Joslin, William H. Long and Elbert Crandall, of New York City.

The Crafts Machine & Tool Company, of Buffalo, N. Y., has been incorporated with a capital of $30,000. Directors: Richard K. Noye, Francis H. Crafts, Henry Koons and Ed. Michael.

The Fries-Breslen Smyrna Rug Company, Camden, N. J., has purchased six acres of ground adjoining their factory in South Camden, upon which a four-story addition to their plant will be erected.

The First National Brewing Company, of Allegheny City, Pa., has been incorporated, the following being the directors: Gottard Wyso, V. W. Thalman, Pittsburg; Adolph Hollander, Braddock, Pa.

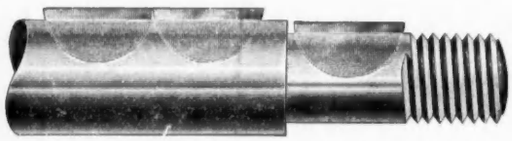
The International Lard & Oil Refining Company has purchased, in the neighborhood of Franklin, Mass., about sixty acres of land. Buildings are to be erected, and employment will be given to 250 hands.

The Davis & Egan Machine Tool Company, of Cincinnati, O., has been awarded a contract by the United States Government for one 30-inch lathe, four 18 x 8 engine lathes and eight 25-inch Standard drill presses.

The Betts Machine Company, Wilmington, Del., will build an addition in the yards. A brick and iron building, 40 x 60 feet, with two stories and basement, will be erected in the vicinity of the group of buildings now there.

Ask your successful neighbor why he has in constant use The Woodruff System of Keying.

P'raps he will tell you that there is an economy in the use of this system amounting to a saving of from 50% to 75% over the ancient way and it does not take an M. E. to figure it.



If you are desirous of knowing how much better these key seats are, and how the new "cub" in the shop can cut them as well as any one, ask for the "Key Seating Tale," now ready, free.

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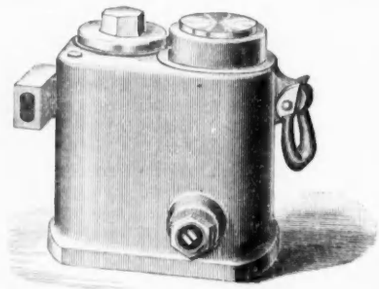

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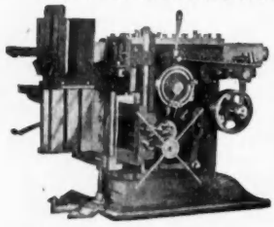

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Such as illustrated here, saves 50 per cent. in cost of thread cutting; dies last ten times as long. No reversing or backing. No drag on threads. Opens and closes automatically. Cuts right or left, taper or straight, and duplicates. Adjustable to 1-1000 of an inch.

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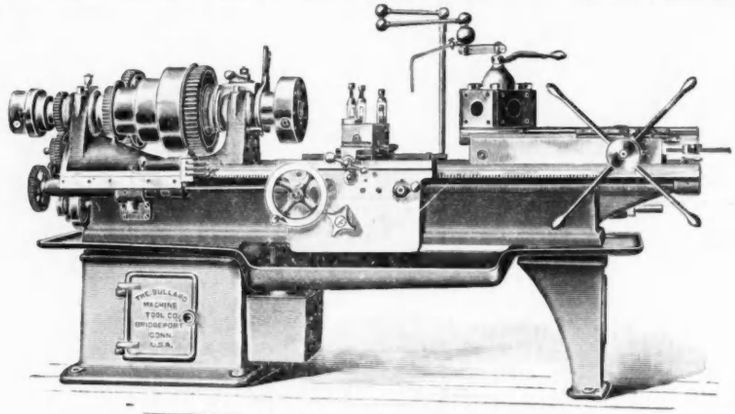

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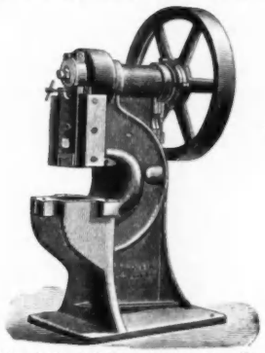

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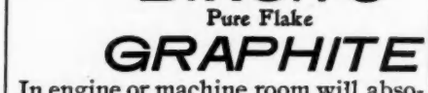

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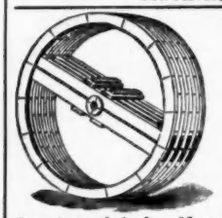

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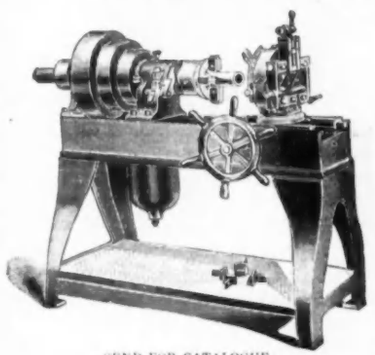

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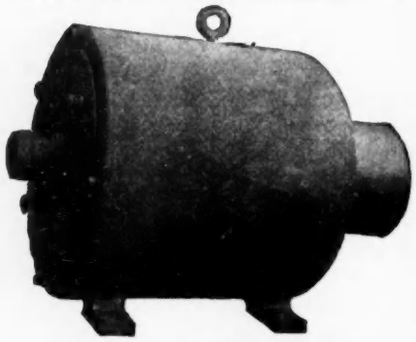

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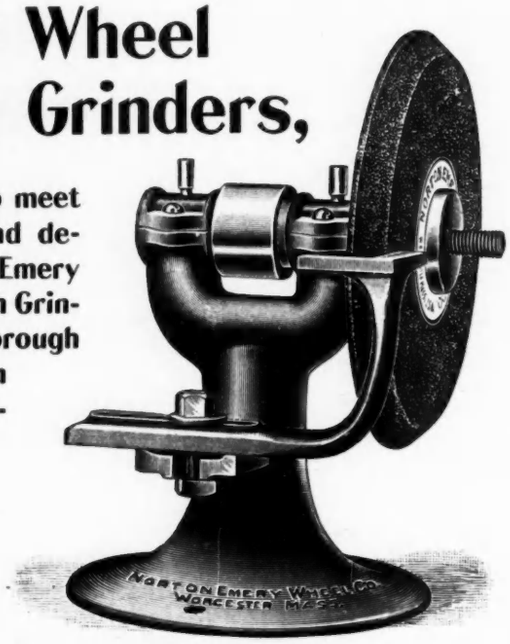

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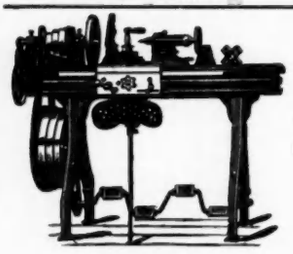

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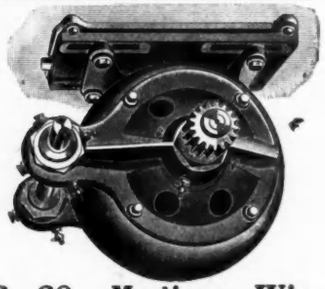

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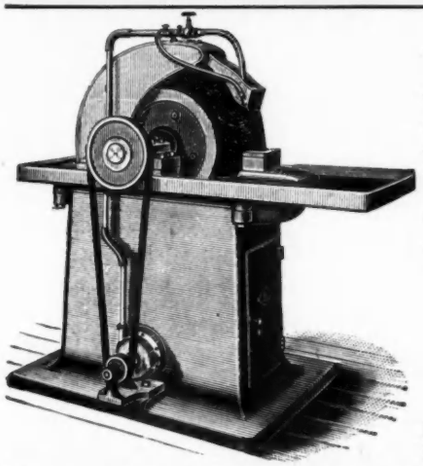

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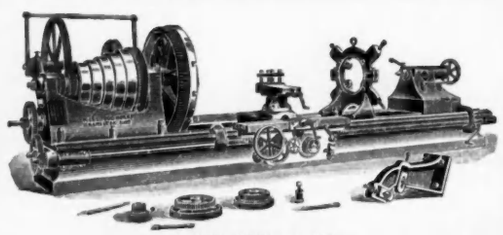

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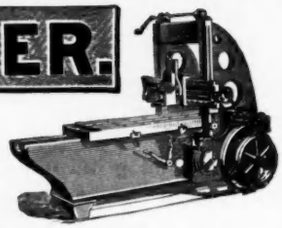

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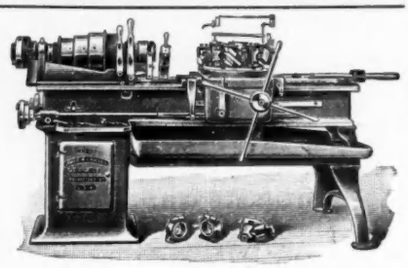

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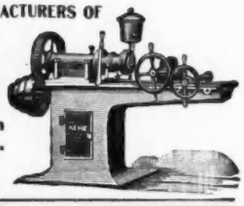

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